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What's in Your Table? The Ecological Influence of Sensory Table Materials on Preschoolers' Play Behavior

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WHAT'S IN YOUR TABLE?
THE ECOLOGICAL INFLUENCE OF SENSORY TABLE MATERIALS ON PRESCHOOLERS' PLAY BEHAVIOR

A Dissertation Presented

by

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DEDICATION

To my sister and *blithe spirit* Mary Lee.

EPIGRAPH

"Our minds need relaxation, and give way
Unless we mix with work a little play."

Molière
The School for Husbands
1661

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ABSTRACT

WHAT'S IN YOUR TABLE?
THE ECOLOGICAL INFLUENCE OF SENSORY TABLE
MATERIALS ON PRESCHOOLERS' PLAY BEHAVIOR

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To achieve multiple learning objectives, the ideal preschool activity center should promote development across all domains, from adaptive to social-communicative. Though early childhood practitioners describe the sensory table as capable of doing so, empirical accounts stand in stark contrast and suggest that it is a non-social functional activity. The intent of the present investigation was to reconcile this distinct dichotomy through the systematic manipulation of four sensory table substances (sand, soil, rocks, and water) and provision sets that differed in realism to determine their effect on preschoolers' free play behavior. Preschoolers' play forms and social participation were observed at the sensory table as they used a novel surface, which was introduced weekly without repetition, and either a set of minimally structured objects or realistic toys. Preschoolers' play and social participation were indeed influenced by the arrangement of the table. The sand, water, and provision sets yielded the most salient effects. Sand pulled for more sophisticated cognitive and social play forms while water pulled for more rudimentary ones. Regarding provision

sets, the highly structured toys pulled for the most mature cognitive play form while the minimally structured toys pulled for the most sophisticated social context. The highly structured toys, with realism that lent to specific themes, appear to have functioned as a thematic anchor and cultivated a greater occurrence of dramatic play as compared to the minimally structured objects, which pulled for more functional play. Conversely, the minimally structured toy set, containing objects that loosely represented realistic objects and/or were capable of multiple functions, fostered a greater amount of socialization through parallel, social, and social-constructive play. Aside from its motoric and adaptive value, findings from this investigation suggest that under certain ecological conditions the sensory table fosters the development of cognitive and social skills. Suggestions for early childhood education practitioners are provided.

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CHAPTER I

INTRODUCTION

The National Association for the Education of Young Children (NAEYC) has long identified play as a powerful mechanism in child development (NAEYC, 2009). A thorough understanding of play and its significance is essential; such cognizance guides decisions for developmentally appropriate practice. Aside from the selection of specific instructional activities, it is necessary to consider the ecological factors that influence children's play in the classroom. The design of an early childhood classroom demands attention to numerous ecological details to ensure that the environment fosters learning through play. These details include, but are not limited to, the allocation of space, classroom arrangement, and selection of furnishings, equipment, and materials; together they constitute the classroom ecology.

The sensory table is an ecological component of the early childhood classroom that serves a dual function as both a furnishing and activity center. Early childhood practitioners are expected to provide a variety of toys and materials at the table for exploration, manipulation, and play. Variety is defined in terms of both physical diversification (e.g., shape and color) and functionality (e.g., scooping and sifting; Harms, Clifford, & Cryer, 2005). Toys available at the sensory table generally afford digging and scooping, dumping and filling, measuring and containment, and/or objects that lend to particular themes (e.g., seeds and plastic flowers for a plant nursery). The decision as to whether to routinely provide a diverse set of toys all at once, or to habitually rotate through distinct toys is at the discretion of the practitioner. Materials that afford digging and pouring, such as sand and water, are to fill the basin of the tub. Collectively, the sensory table and its supplies are thought to be a fundamental component of a high quality early childhood classroom as the

lack of a table or provisions for sand/water play is claimed to be an indicator of an ecological inadequacy in the classroom environment (Harms, Clifford, & Cryer, 2005). Though the sensory table is considered integral in classroom composition, the effect of various objects and material types on preschoolers' play behavior (i.e., cognitive and social) has not been previously studied.

The present investigation examined the ecological influence of sensory table objects and materials on preschoolers' play behavior. Preschoolers' play forms (i.e., functional, constructive, dramatic, and games-with-rules) and social participation (i.e., solitary, parallel, and social) were observed at the sensory table as they used a novel surface (i.e., pebbles, sand, soil, and water), which was introduced weekly without repetition, and either a set of unstructured objects or realistic toys. This systematic observation of preschoolers' cognitive and social play behaviors was executed to determine if distinct surface materials and objects provided at the sensory table encourage specific types of play leading to differential forms and contexts. The investigation's intent was twofold: 1) to contribute to the theoretical understanding of how ecological factors, such as materials and objects, affect play behavior and 2) to provide early childhood education practitioners with best practice recommendations for instructional design (e.g., which surface and toy set is best if the sensory table is to be used for teaching adaptive domain skills).

This chapter begins with a discussion of play as a context for children's cognitive and social development. Later sections discuss ethological accounts of materials functioning as an impetus for play in non-human animals, infants' exploration of materials, and the influence of materials and objects on children's play. The various types of sensory tables and suggested materials and objects will also be described, as well as instructional activities and

recommendations from early childhood education practitioners. A list of guiding research questions concludes the chapter.

A. Free Play: A Context for Cognitive & Social Development

For decades, researchers have repeatedly called for more investigations on children's free play behaviors (see Pellegrini, 2005; Rubin, Fein, & Vandenberg, 1983). Pellegrini (2005) found appeals for studies on children's game play to span over 50 years, appearing somewhere in the literature of every decade since the 1950s. The origin of more general calls is likely traced even further to play's heyday in the 1930s during the child study movement. Regrettably, the calls have remained largely unanswered. Though play is seldom given a chapter in the *Handbook of Child Psychology* (one chapter in the 1983 volume, but otherwise none), it has certainly not been abandoned. The dearth of extended empirical attention is conceivably explained as a matter of focus, not a lack of interest. When play is studied, instead of building wholly on Piaget's (1962) or Smilansky's (1968) cognitive play forms and Parten's (1932) social participation categories, the prevailing disposition is to focus exclusively on children's dramatic play (Rubin, 1977b).

Requests for innovative empirical reports that further the literature in a particular area are common, and indeed many researchers will conclude a manuscript with a discussion of potential future initiatives. In this sense, play is no different than any other behavior of interest. Exceptionality lies in what play has been given and how it is viewed. Researchers and practitioners have attributed extraordinary mechanistic power to this behavior; play is said to be capable of comprehensively nurturing the developmental process through the growth and interaction of all domains (see NAEYC, 2009). Demands for research initiatives are not only warranted, they are justified, because play is valued as influential in both

cognitive and social development (Bruner, 1972; Kohlberg, 1968; Vygotsky, 1967), but has yet to be fully understood and substantially quantified. Notions of instrumentality aside, empirical neglect is even more surprising when one of the most celebrated sources is considered. With regard to cognition, researchers have employed the play concepts of Piaget; his sequential forms of cognitive play function as half of the categorical system for the observation of children's play. Theoretical and methodological approaches to the study of children's free play yoke Piaget's seminal theory of cognitive development and Parten's classic study on social participation, which persist as the principal works in the field.

Piaget (1962) describes three play forms (i.e., practice, symbolic, and games-with-rules), which correspond to the successive forms of intelligence described in his theory of cognitive development. From a Piagetian perspective, children's engagement in higher order play forms is advantageous for their knowledge acquisition. Symbolic and games-with-rules play fosters cognitive and social abilities that contribute to children's intelligence and progression through the stages of development. Unlike practice play (also termed functional play), the requisite behaviors associated with symbolic and games-with-rules play have greater complexity and the quality of play is more sophisticated.

Symbolic play reflects preoperational intelligence and necessitates representational ability. Piagetian theory posits that symbolic play allows children to practice and develop their understanding of semiotics, which in turn contributes to their language development because symbol use (i.e., the semiotic function) is a precursor to it (Piaget, 1962). With this cognitive ability of symbol use, a funnel at the sensory table can be used for more than substance manipulation; a child can play with the funnel as if it were a birthday hat or musical instrument (e.g., horn). The preceding example of a child's potential behavior with

the funnel illustrates the progression from practice to symbolic play, with the substitution behavior in the latter indicating representational thought. Describing the child's play behavior as indicative of thought is appropriate, for Piaget finds symbolic play to be demonstrative (Fein, 1979); this perspective stands in contrast to Vygotsky's sociocultural theory. Though Vygotsky (1967) also emphasized the significance of symbolic play in his theoretical views, unlike Piaget, he identified children's use of symbols to represent concepts during symbolic play as essential to their developing linguistic competence. Whether viewed as a reflection of thought or as a factor in language acquisition, both Piaget and Vygotsky find symbolic play to promote cognitive development during the preschool years.

From a schooling standpoint, conceptualizing play as a developmental progression suggests that preschoolers' symbolic play in an early childhood education classroom prepares them for games-with-rules play in elementary school (see Piaget, 1962). Games-with-rules play requires the abstract thought associated with operational intelligence and demands competency in negotiation, shared-perspective, and the ability to conform to established rules (Piaget, 1962). Moreover, games-with-rules play fosters the development of social abilities through positive peer interaction. Piaget (1962) identified this play form as emerging during the child's concrete operational stage (from 7 to 11 years). However, researchers have observed children to engage in some games-with-rules play during their preoperational years in preschool and kindergarten (Rubin, Maioni, & Hornung, 1976; Rubin, Watson, & Jambor, 1978). This developmental window suggests greater variation in games-with-rules activities as compared to practice or symbolic play.

Games-with-rules are observed to range in their intricacy (Sutton-Smith, 1973; 1975), they do not necessitate equipment and/or the assignment of multiple roles. A rudimentary

understanding of even a few simple games may serve as a socializing agent for play initiation (Pellegrini, 2005). Simplicity is exemplified through common tagging and chasing games, where a child is either "it" or "not it," running to capture or escape from a peer, respectively. Though the game itself lacks the complexity of more sophisticated games, such as kickball, it does involve two or more children entering into a competition governed by pre-established rules (see Piaget, 1962). Mastery of these initial games during early childhood (e.g., preschool) provides a basis for subsequent assimilation of games with greater complexity in later childhood (e.g., elementary school).

Contrary to the other play forms, games-with-rules is dependent upon social participation. A social participation hierarchy for play was first established by Parten (1932), who identified six sequential categories: unoccupied behavior, onlooker, solitary independent play, parallel activity, associative play, and cooperative or organized supplementary play. Unoccupied behavior is used to describe a child who is not playing or watching the play of others; an onlooker is watching, but not playing. In solitary independent play, the child engages in play independently of others and with his/her own discrete toys. Precise observation of the child's toy selection and distance from other children is imperative; play with a toy that is similar to those of the surrounding children is defined as parallel activity. Only associative and cooperative play, Parten's highest order forms, involve actual social interaction (e.g., togetherness and sharing). While contemporary psychologists commonly consolidate these two forms into one (e.g., social), Parten marked the division of labor as characteristic of cooperative play, parsing it from associative.

Social skills are developed through associative and cooperative play. When play is part of the school day, it permits unfettered peer interaction outside of structured classroom

activities and routines. Essential skills that are necessary for proper social functioning, such as manners and conversational exchange, are acquired by experience during casual peer interactions (Grice, 1975). During the course of these unstructured interactions, children learn to cooperate and share perspective, whereby the requisite skills for social competence are developed (Katz & McClellan, 1997). Social play episodes that necessitate accommodation cultivate language and social development, as peer discourse is found comparable to instructional discourse during conflict resolution (Heath, 1983). Because of their social training, children form friendships, gain popularity, and are likely to maintain a favorable view of school because of their friend(s) (Coie & Dodge, 1998; Pellegrini, 2005). Moreover, the social networks established through positive peer interaction are found to contribute to overall academic success in the adjustment to school (Ladd & Price, 1987; Pellegrini, Kato, Blatchford, & Bains, 2002).

Play requires scheduling so that domain competencies can be achieved. In allocating time for play, practitioners can foster development through activities structured around specific learning objectives and the supply of appropriate materials. Outside of daily, organized instruction, free play provides a rich age-appropriate experience that learners find to be meaningful (NAECS/SDE, 2001). From a holistic perspective, play may be beneficial for the development of the "whole child." When taking a whole child approach to classroom instruction, practitioners are encouraged to identify learners as the sum of interconnected parts (Eisner, 2005). They are to be cognizant of learners' needs for healthy growth, which includes attention to their moral and social development (Noddings, 2005). Cognitive, moral, and social skills may easily be cultivated through the identification of play activities and materials that will maximize their growth and attainment. The challenge is to determine

the effect of conventional classroom activities on children's play behaviors so that practitioners can align activities in accordance with cognitive and social learning objectives.

B. Influence of Materials on Non-Human Animal Play

Surface is often highlighted as an ecological factor influencing the play of non-human animals. Whether part of the setting or furnished by a researcher, materials are observed to attract and stimulate play behavior. For example, snow elicits sliding and tumbling in ravens (*Corvus corax*; Heinrich & Smolker, 1998) and free-ranging bighorn lambs (*Ovis canadensis canadensis*; Bennett & Fewell, 1987). Moreover, Bennett and Fewell (1987) suggest the presence of snow as one possible ecological factor for the observed differences in the play behavior of captive and free ranging bighorn lambs. Mountain lambs appear to identify snowfields as affording locomotor play; the aforementioned behaviors were not observed in the captive group, presumably because of their awareness of injury on concrete surfaces (Bennett & Fewell, 1987). Differential responses to surface hardness are also observed in herring gulls, *Larus argentatus*. Herring gulls selectively tailor their actions when dropping mollusks' over substrates, making foraging drops over hard surfaces to break the shell and "drop-catching" over soft surfaces to catch it before it hits, with the latter exemplifying play (Gamble and Cristol, 2002).

Brown (1988) observed lowland gorillas, *Gorilla gorilla gorilla*, frequently concentrated their play around water. Playing both with it and in it, the gorillas' behaviors ranged from splashing in a small pool to running through sprinklers. Water's promotion of play has also been reported for the American alligator (*Alligator mississippiensis*). During their field study, Lazell and Spitzer (1977) observed a young American alligator playfully "drip-snapping" at water trickling from a pipe. This account is particularly noteworthy for

play is most commonly reported in mammals and birds, while evidence for play in reptiles is limited (Fagan, 1981); it indicates available materials may have a significant effect on behavior. Other materials, such as leaves, sawdust, and straw, show comparable effects in eliciting play. Beluga whales, *Delphinapterus leucas*, will play with leaves that have fallen into their pool (Delfour & Aulagnier, 1997) and the provision of sawdust and/or fresh straw is described as an impetus for play in domestic dairy calves (*Bos taurus*, Jensen, Vestergaard, & Krohn, 1998) and spotted hyenas (*Crocuta crocuta*; Pedersen, Glickman, Frank, & Beach, 1990).

Along with surface, it appears that naturally occurring objects can also incite play; accounts range from simple object-directed actions to behaviors that appear to be game-like. Anecdotes about horses provide evidence for what is best described as functional play; they are observed to exploit sticks for back scratching and raking snow (Campbell, 1977; van Lawick-Goodall, 1970). Informal avian observations suggest rudimentary games play. Twigs and sticks seem to be a stimulus for play in ravens, *Corvus corax*, and ground hornbills, family *Bucerotidae*, as they are used for drop-catch during flight, "pass-the-stick," and 'tug-of-war" (Heinrich & Smolker, 1998; Kemp's study, as cited in Diamond & Bond, 2003). Moreau and Moreau's (1944) game narrative for white-necked ravens playing "king of the castle" is perhaps the most descriptive and compelling. The game involves one bird rushing up a mound of grass to tussle with the bird atop for the object it is holding. Surely these observational accounts of birds' games do not conform entirely to Piaget's description of games-with-rules for children. Birds do enter into a competition between each other. However, it is not possible to determine whether these behaviors are rule governed (see Piaget, 1962). Instead, "tug-of-war" and "king of the castle" may best fit somewhere

between the definition of functional and games-with-rules play. Unlike functional play, the birds' behaviors appear intentional and organized around a central purpose, but may lack the sophistication associated with criteria that regulate games-with-rules play. Moreover, avian game play may be motivationally distinct from that of children. Definitions, intent, and motivation aside, naturally occurring objects, like tree debris, are found to encourage play and social participation.

Though descriptive, these accounts collectively indicate that materials in non-human animals' physical environment can affect their actions and how they play. Comparative perspectives on materials and play are certainly relevant. Besides informing our general understanding of ecological effects on play, the materials that appear to attract non-human animals to play are also identified by early childhood education practitioners as potential materials for the sensory table tub (see Koch, 2008; West & Cox, 2001). When using a thematic approach to curriculum development, the materials provided at the sensory table ordinarily coincide with the theme. Herr and Larson (2009) recommend leaves and snow for seasonal themes, sawdust for construction, and straw to support a farm animals or barnyard theme. Water may have the greatest utility; it supports a wide variety of themes, including aquatic, containment, health, and weather, as well as affording basic dumping and filling (Herr & Larson, 2009; West & Cox, 2001). With regard to objects, sticks lend to environmental themes. Like non-human animals, children incorporate sticks into their play; these natural objects are referred to as "play props" and are used to build structures and other tangible creations (see Moore, 1988). Instead of simply providing these materials at the sensory table to extend a theme throughout the classroom, the effect of various material types

on children's behavior should be investigated to determine if materials foster play in children as they do in non-human animals.

C. Infants' Exploration of Materials

Though few studies have specifically examined infants' perception-action routines with objects relative to the available surface, initial findings suggest that sensitivity to potential interrelations develops during the first year of life. When exploring the hardness of an object, 6- to 12-month-old infants discriminate between pliable and rigid objects through pressing and banging, respectively (Bushnell & Boudreau, 1993; Lockman & Wright, 1989; Palmer, 1989). Gibson and Walker (1984) observed comparable compression and banging in 12-month-old infants during manipulation of an elastic and rigid cylinder in the dark, suggesting similar haptic exploration irrespective of vision.

As the first to vary tabletops during exploration, Palmer (1989) observed that infants' actions are affected by the properties of the surface, whether part of the executed action sequence or not. She characterized the nature of a tabletop as both a means of support and "second object." Bourgeois, Khawar, Neal, & Lockman (2005) have recently extended these findings by showing that 6-, 8-, and 10-month-old infants adapt their manual actions in response to both an object's material properties and the surface on which it is explored. Bourgeois and colleagues' observation of object and surface interaction revealed that infants banged hard objects more often on hard and taunt surfaces as compared to liquid or spongy surfaces.

Observations of the effect of surface on infants' manual actions are not limited to tabletop and highchair contexts. Infants are observed to tailor their actions even when seated directly on the floor. Morgante and Keen (2008) sat 8-month-olds on carpet and hardwood

floors and found that infants engaged in more surface-directed banging on the hardwood floor. Though the surface was not immediately available (i.e., directly in front of the infant) or necessary to exploit the properties of the object, infants appropriately discriminated between the surfaces and may have used the hardwood floor in their action routine to maximize stimulation across the sensory domains during their exploration. Collectively, the aforementioned studies indicate infants' perception-action routines are influenced in part by ecological resources and their possibilities. In Piagetian terms, objects and materials influence infants' practice play.

D. Materials and Children's Play

Without methodological consistency in the conditions under which free play is observed, results may be context dependent, rendering normative data and behavioral generalizations impracticable. Investigation variation is likely inevitable if researchers fail to control for the activities, materials, and attributes of the play setting. Depending on what is available to them, children's play forms and social participation in a naturalistic or structured setting may be governed by their surroundings. This force of an activity or object on a child's behavior is described as its "pull for" play (Rubin, Fein, Vandenberg, 1983). Several activities are found to be distinctly influential in shaping children's play in the preschool classroom.

Regarding socialization, art (e.g., crayoning, painting, and play dough), sand and water, and puzzle activities ordinarily elicit non-social behavior, either solitary or parallel play, whereas domestic materials (e.g., house equipment and dress-up materials) and vehicles tend to be social (Parten, 1932; Rubin 1977a, 1977b). When it comes to quantity, the adage "less is more" might be an appropriate recommendation for infant and toddler program

practitioners. Objects can function as a catalyst in social interaction, providing opportunity for joint attention, exchange, and shared exploration. However, they can also detract from social interaction. In an investigation comparing interaction in a playroom with or without toys, Eckerman and Whatley (1977) reported a greater frequency of social communication (e.g., smiles, gestures, and laughs) for 10 to 12- and 22 to 24-month-olds in the absence of toys. Obviously a classroom cannot be void of activities and objects. Collectively, these investigations indicate that researchers and practitioners must be sensitive to the type and quantity of materials provided as both are likely to contribute to children's social behaviors during free play.

Focus on activities and/or materials alone is possibly too strict, for the heart of the "pull" may be the aim of the classroom itself. Vandenberg (1981) studied social play in a preschool that was somewhat unique. Within the setting there were two distinct areas; one area was designated as the "big muscle" room and the other as the "fine motor" room. The purpose of the "big muscle" room was to exercise large muscle groups and, as the name implies, the "fine motor" room to develop fine motor skills. Children's social behavior was observed to be a function of room type. The "big muscle" room "pulled for" social play and the "fine motor" solitary and/or parallel. Moreover, the size of the playgroups in the rooms for each type of play was also affected. A polar relationship between the rooms was observed: playgroups were larger when playing socially in the "big muscle" room and in a parallel manner in the "fine motor" room.

As noted by Vandenberg himself, perhaps the most salient finding of this study was one that had not been observed. Using Parten's (1932) categories, social play was further defined as either associative or cooperative; the delegation of roles is what distinguishes

cooperative play from associative. The researchers observed associative play, but not cooperative play. Vandenberg speculates that the reason for this is presumably due to the absence of materials that would have encouraged cooperation among the children. The rooms were intended to promote motor development, not higher order social interaction; this learning objective was observed and accomplished. Gibson and Pick (2000) posit that one's detection of what a space affords and its layout subsequently influences behavior and indeed preschoolers are observed to engage in behaviors that conform to the environmental context (e.g., building a "castle" in the block area or reading a story in the book area, Shure, 1963). These findings suggest that the designated function of a room *and* the materials found within can affect preschoolers' social play.

With reference to cognitive play forms, play dough and sand and water activities are associated with functional play, painting, crayoning, and puzzle activities with constructive play, and domestic materials and vehicles with dramatic play (Rubin 1977a, 1977b; Rubin et al., 1983; Shure, 1963; Tizard, Philps, & Plewis, 1976; Vandenberg, 1981). Moreover, the coupling of social participation with cognitive play forms suggests that domestic materials and vehicles "pull for" the highest levels of play (i.e., sociodramatic) while play dough and sand and water activities "pull for" the lowest (i.e., non-social functional). Notwithstanding their social-cognitive play form, play dough and sand and water materials are among preschoolers' preferred activities, as indicated by their observed classroom activity engagement (Rubin 1977a, 1977b; Tizard, Philps, & Plewis, 1976). Speculation as to why children might prefer the activities that are the least sophisticated is difficult; their preference may be attributed to the novelty of the activity, consequences of the action (e.g., seeing water

power a mill or a cookie cutter form a shape), popularity, social-cognitive maturation, or perhaps a combination of these factors.

A potential shortfall of these preschool studies, as noted by Rubin, Fein, and Vandenberg (1983) in their *Handbook* chapter on play, is that children who participated were observed naturalistically and the investigators did not control for or manipulate the classroom provisions. Furthermore, the aforementioned activity and object "pull" observations characterize children's probable behavior when acting on their own volition in their classroom. They reference Krasnor and Pepler (1980), who questioned the reported material effects, as they may be confounded with individual play preferences, and suggested that future investigations experimentally manipulate play provisions. Rubin and colleagues go on to report three investigations that empirically examined the effects of toys on preschool-aged children's play behaviors, one on toy presentation and the other two on structure.

With puzzles, children will engage in both constructive and dramatic play when the pieces alone are presented, but only constructive when the pieces are presented in conjunction with the corresponding board (Pepler's dissertation study, as cited in Rubin et al., 1983). Toy structure, defined in terms of realism, also appears to contribute to children's quality of dramatic play. Pulaski (1970) observed 5- to 7-year-olds to enter into a greater variety of fantasy themes when minimally structured toys were available (e.g., blocks, cardboard boxes, and dress-up clothes) as compared to highly structured (e.g., Barbie, G.I. Joe, and completely constructed buildings). When Fields (Fields' thesis study, as cited in Rubin et al., 1983) exposed preschoolers to two large boxes, one painted abstractly and the other like a car, more dramatic play occurred with the "car," albeit mostly around transportation themes, while a greater number of dramatic elements were observed with the

abstract box. Realism therefore may function as a catalyst for dramatic play, increasing its frequency, or an agent in its thematic scope.

The paucity of research on materials and children's play has persisted from the time of the play chapter's publication in the *Handbook* until now. Specifically, we need quasi-naturalistic studies that: (1) explicitly identify an activity within the preschool setting, (2) control for and systematically manipulate the provisions, and (3) observe all of the children enrolled in the class and not just the ones that self-select into the activity. With regard to the final point, currently, the term "pull" simply describes likely behavior in the absence of instructional support or teacher guidance and does not account for organized free play groups; the term requires greater breadth. Though some activities and objects appear more favorable for social and cognitive development, a thorough analysis of each is necessary to reliably determine behavioral influence and educational value. Characteristic knowledge of this kind will subsequently enrich the literature on children's free play behavior and provide practitioners with an understanding of how best to use classroom activities to achieve social and cognitive learning objectives. Being a staple that uses both objects and materials, the sensory table was selected as an appropriate starting point for this research program.

E. Anatomy of a Sensory Table

Sensory tables are available for purchase in a variety of shapes, sizes, and material compositions (for a detailed buying guide see Morris, 1990). Taking circular, rectangular, and square form, sensory tables are commonly made of high-impact resin, resilient plastic, rugged acrylic, or solid maple. Tables may have either one tub or two separate tubs, allowing for one provision or dual material use at one piece of equipment, respectively. Like other activity centers within the early childhood classroom, sensory tables can comfortably

accommodate the play of several children at a time. Though some tables are smaller than others, designs generally afford enough space for at least two children's active play; the design does not inherently lend itself to privacy or solitary play. The overall dimensions of rectangular sensory tables, designed for several children, afford approximately 3 to 4 sq. ft. of play space (i.e., the volume of the tub; see Constructive Playthings, 2008). When selecting a sensory table for the classroom, practitioners will likely base their decision on ecological and financial resources because the *Early Childhood Environmental Rating Scale* (Harms et al., 2005) does not specify or describe a particular standard. Instead, as part of an "excellent" rating for sand/water, it simply requires that a table be: (1) separate from the designated outdoor sensory play space, and (2) a regular part of the program.

Once a sensory table has been purchased, the decision as to what to fill it with is explicitly addressed in the ECERS, where material guidelines for filling the basin of the tub are delineated. Materials that afford digging, filling and pouring are the most appropriate (Harms et al., 2005). Sand and water are the staples. This is reflected in the conventional name for this piece of equipment, which is the "sand and water table." This by no means implies that they are the only suitable materials. Sand alternatives, like birdseed, rice, and woodchips, are acceptable if the material does not pose a health or safety issue and has comparable manipulative properties, affording the same behaviors as sand. Practitioners suggest using dirt, gravel, pebbles and small rocks as a substitute for sand (Morris, 1990; West & Cox, 2001). Directions for water substitutions are not provided in the ECERS; however, the same principle can be applied. Instead of changing the material, with water practitioners are able to vary its physical state and use ice cubes and snow. Its function can also be modified through the addition of food coloring or dish detergent for bubbles.

Regardless of what is used to fill the tub, a potpourri of objects should be available at the sensory table, lending to both the material and desired exploratory behaviors, to provide a proper arrangement conducive to play. Lists with practitioner recommendations typically include figurines, kitchen and bakeware (e.g., objects for containment, measure, mixing, pouring, and scooping), sand toys (e.g., buckets, mills, shovels, and sifters), and vehicles (see Herr & Larson, 2009; West & Cox, 2001). Also, when applying a thematic approach to the sensory table, specific supplies may be incorporated into the center to support an established theme (e.g., plastic plants and flowers for a garden activity).

Modifying the materials and having a diverse stockpile of objects is advantageous for it enables children to engage in various activities, which will subsequently contribute to the development of various domains. Contrary to diversification, static materials and objects with similar utility hamper play through the constraint on resources. A sensory table that has only a few shovels and is filled with sand, for instance, would limit the child's behavioral response to digging and scooping. Furnishing an early childhood classroom with a sensory table is not enough, as the benefit from this activity stems from its enrichment. To achieve a particular learning goal or objective, a practitioner might design an instructional activity, like a science experiment on buoyancy, force, states of matter, or viscosity (see Church, 2006; Dinwiddie, 1993), around the sensory table and assume the role of skilled collaborator during play. However, in purist practice, the center should foster unfettered free play, with resources functioning as the focal point and practitioner-child interactions limited to informal instructional guidance (e.g., having children talk about their activity).

F. Overview of the Current Investigation

Early childhood practitioners identify the sensory table as an activity center that promotes development across the domains: cognitive, emotional, linguistic, physical, and social. Moreover, it is described as a mechanism for the development of problem-solving abilities, imagination, verbal communication, self-esteem, conflict negotiation, and hand-eye coordination (Morris, 1990: West & Cox, 2001). However, results of empirical investigations are entirely antithetical to these beliefs. Though popular among preschool children, this activity has been observed to "pull" for the least sophisticated forms of cognitive and social play. This investigation focused exclusively on the sensory table and its provisions to determine its effect on preschoolers' play behaviors. Following the aforementioned methodological outline, this study: (1) explicitly identified an activity within the preschool setting, (2) controlled for and systematically manipulated the provisions, and (3) used a methodological design that enabled the author to observe all of the children enrolled in the class and not just the ones that self-selected into the activity.

This investigation filled a current gap in the literature; it answered the general call for more research on free play with a contemporary study that utilized the social-cognitive framework of Parten and Piaget (see Pellegrini, 2005; Rubin, Fein, & Vandenberg, 1983). Furthermore, it addressed a shortfall in the area of ecological influence. In contrast to prior investigations, the present study controlled for possible material effects that may have resulted from individual differences in activity preference (see Krasnor & Pepler, 1980). This was achieved through the observation of every child, not just the ones observed by happenstance. Following Krasnor and Pepler's (1980) recommendation, the design also

included controlled manipulation of the provisions. Provisional influence was measured by comparing the effect of unstructured objects and highly structured toys on children's play.

Perhaps the most significant angle of this study is its applied value. The preeminent educational resource on early childhood classroom ecology does not definitively indicate the objects and materials that are optimal for maximizing the potential developmental value of this activity center. Ecological cognizance of the effect of objects and materials on children's play behavior will provide practitioners with an understanding of how to structure the sensory table in order to achieve learning objectives across the various domains. If play with certain objects and materials results in cognitive and social differences, then an understanding of these effects is essential for decisions that guide instructional design. Practitioners cannot presume such things as emotional and linguistic value based on provision diversification and quantity alone. Knowing the actual influence of objects and materials common to the sensory table will enable the tailoring of specific domain learning objectives (e.g., adaptive, cognitive, motor, and social) to the ecological arrangement. Thus quantifying the specifics of play's assumed developmental power. Materials that "pull for" Piaget and Parten's highest play forms, namely dramatic, games-with-rules, and social, are ideal for they cultivate the development of language, problem solving, and shared-perspective; combined, they foster children's knowledge acquisition (see Piaget, 1962). The empirical design of this investigation was aimed at identifying the surfaces and provisions that achieve this cognitive and social play.

Guiding Research Questions

Question 1

Does the available surface type at the sensory table influence preschoolers' behavior, leading to different forms and contexts of play?

Hypothesis:

Anecdotal observations of non-human animals' play and empirical investigations on infants' exploration of materials suggested that children's manual actions would fit the arranged context (i.e., they would perceive the affordances). Prior investigations on preschoolers' free play had not described the ecological conditions under which sensory table play was observed. For this reason, it was difficult to predict which surface(s) was/were likely to foster dramatic or games-with-rules play and social participation. The ECERS does require the provision of both wet and dry materials so a comparison was warranted.

Question 2

Is play and social participation at the sensory table influenced by the structure of the provided objects?

Hypothesis:

Given the age of the children who participated in Fields' box study, the author predicted that highly structured toys, with realism that lent to specific themes, would function as a thematic anchor and cultivate dramatic play more so than would unstructured objects (see Fields' thesis study, as cited in Rubin et al., 1983). Realistic domestic materials, figurines, and vehicles were expected to increase the amount of social play (see Parten, 1932; Rubin 1977a, 1977b; Vandenberg, 1981).

Question 3

Is sensory table play a product of the interaction between the provided objects and surface type?

Hypothesis:

Studies of ecological influence suggested this to be likely; infants' practice play is indeed influenced by object-surface combinations (Bourgeois et al, 2005; Morgante & Keen, 2008). However, there were no prior investigations with preschoolers to inform clear interrelation predictions.

Question 4

If early childhood education practitioners plan on using the sensory table to achieve cognitive domain objectives (e.g., "The child will engage in imaginary play using imaginary props;" Bricker & Pretti-Frontczak, 1996) and social domain objectives (e.g., "The child will use words, phrases, or sentences to express anticipated outcomes;" Bricker & Pretti-Frontczak, 1996), what objects and surface would best achieve such learning objectives?

Hypothesis:

It was predicted that the realistic domestic materials, figurines, and vehicles would be most appropriate for achieving cognitive and social learning objectives (Parten, 1932; Rubin 1977a, 1977b; Vandenberg, 1981).

CHAPTER II

METHOD

A. Setting

This study was conducted at Holy Cross Lutheran Preschool in Bordentown, New Jersey, in the spring of 2009 (March through May). The preschool offers 2-, 3-, and 5-day sessions in the morning and afternoon for children 3 and 4 years of age. Four classes are offered for the 3-year-olds, meeting either two (Tuesday/Thursday) or three (Monday/Wednesday/Friday) days a week in the morning or afternoon. Morning classes meet from 9:00 am – 11:30 am and afternoon classes meet from 12:30 pm – 3:00 pm. Each class session is 2 ½ hours long. Five classes are offered for the 4-year-olds, meeting two (Tuesday/Thursday), three (Monday/Wednesday/Friday), or five days a week. Three classes meet three days a week, two from 9:00 am – 1:00 pm and one from 9:00 am – 3:00 pm for 4 and 6 hours, respectively. One class meets two days a week from 9:00 am – 1:00 pm for 4 hours. The final class meets daily for 3 ½ hours from 9:00 am – 12:30 pm.

Following state guidelines and recommendations for best practice, enrollment is set at 136 children, with 56 children in the 3-year-old sessions and 80 children in the 4-year-old sessions. Thus, there were 14 children in each of the 3-year-old classes and 16 children in each of the 4-year-old classes. At the time of recruitment, 131 children were enrolled for the 2008-2009 academic year, 51 children in the 3-year-old sessions and 80 children in the 4-year-old sessions. Enrollment statistics fluctuated slightly during the academic year because of new enrollments, family relocations, and placement in early intervention programs after the identification of a developmental disability.

Each class had a teacher and an assistant. Kelly Russell and Claudine Diaz taught the 3-day (Monday/Wednesday/Friday) classes and Dana Marie Haas and Tracy DeCicco taught the 2-day (Tuesday/Thursday) classes. Kathy Schroeder is the preschool director. The Holy Cross Lutheran Church board members who approved of this study are Pastor Garrett Knudson, Kathy Schroeder, Peggy Gens, and Heather Tuller.

A lack of ecological and methodological consistency in the study of preschoolers' free play has been identified as a potential shortfall for this area of research (Rubin et al., 1983). Contrary to prior methodological designs, the investigator wanted to incorporate a global measure of environmental quality into the design of this investigation to clearly set the activity of interest within the context it occurred and impart consistency. An assessment of a preschool's environmental quality permits the control of the context through the quantification of it and allows for direct comparison with similar future studies. Thus addressing previous concerns with materials research.

The *Early Childhood Environment Rating Scale* (ECERS-R; Harms, Clifford, & Cryer, 1998) is a standard measure for the early childhood field and was administered at the beginning of the academic year to assess the quality of the Holy Cross Lutheran Preschool program and provide a descriptive overview of its furnishings, routines, structure, and practitioners' behaviors for generalization and replication purposes. Anecdotal observations made during an initial site visit in May 2008 indicated that Holy Cross offered a high quality program that would score between 5.75 and 7.0 for overall program quality. In other words, it was anticipated that the program's score would be between a *Good* (5.0) and *Excellent* (7.0) rating.

The scale was scored after several observations during the week of October 13-17, 2008. A total mean scale score of a **5.95** was obtained after all of the items scored for the entire scale were summed (Total Subscale Score = 238) and divided by the number of items scored (Number of Items Scored = 40). *Program Structure* was the only subscale that scored an *Excellent* rating (TSS = 21; NIS = 3; Average Score = 7.0). Four of the seven subscales averaged a score above a 6.0; the subscales with a near excellent rating were *Personal Care* (TSS = 34; NIS = 5; Average Score = 6.80), *Language-Reasoning* (TSS = 25; NIS = 4; Average Score = 6.25), *Interaction* (TSS = 34; NIS = 5; Average Score = 6.80), and *Parents and Staff* (TSS = 38; NIS = 6; Average Score = 6.33). The remaining two subscales scored a *Good* rating; these subscales were *Space and Furnishings* (TSS = 40; NIS = 8; Average Score = 5.0) and *Activities* (TSS = 46; NIS = 9; Average Score = 5.11).

With regard to *Space and Furnishings*, at the time of assessment the 3-year-old classroom lacked a cozy area (*Furnishings for relaxation and comfort* = 3; *Minimal*) and designated space for privacy (*Space for privacy* = 3; *Minimal*). Moreover, the quiet reading area overlapped with the block/fine motor area (*Room arrangement for play* = 4; *Minimal-Good*) and children's artwork did not dominate the classroom (*Child-related display* = 3; *Minimal*). These four measures contributed to the lower subscale score for *Space and Furnishings*. The measures that affected the *Activities* subscale score were *Music/movement* (Average score = 4; *Minimal-Good*), *Nature/science* (Average score = 3; *Minimal*), *Math/number* (Average score = 4; *Minimal-Good*), and *Promoting acceptance of diversity* (Average score = 3; *Minimal*).

There were many musical instruments and materials, but they were stored in a closet and not available for use outside of planned activities. *Nature/science* and *Math/number*

activities were integrated into circle and center time, but the room lacked designated centers for these two activities and did not have the "many" materials required for a 5 to 7 rating. Diversity is promoted in the Christian curriculum and through "some" books and toys available in the quiet reading, block, and dramatic play areas. However, the room lacked props representing various cultures that can be used for dramatic play (e.g., ethnic clothing, foods, and eating utensils), "many" books, pictures, and materials showing people of different races, cultures, and ages, and the inclusion of a daily diversity routine (e.g., ethnic foods are a regular part of snacks) required for a 5 to 7 rating.

Upon completion of the assessment, the investigator shared the obtained results in a meeting with the program director and classroom teachers. Ideas for improving the room arrangement (i.e., *Space and Furnishings*) were discussed in a classroom "walk-through" that followed the meeting. After exploring potential configurations through physical manipulation, the quiet reading area was finally divorced from the block/fine motor area and relocated to the opposite corner of the room; a quiet reading/cozy area, allowing space for privacy, relaxation, and comfort, was created. A "living room" set, with loveseat and chair, was also ordered for the space. Children's artwork no longer went home on a daily basis. Instead, two- and three-dimensional pieces, which reflected current themes in the curriculum, adorned the classroom.

In cooperation with the practitioners at Holy Cross Lutheran Preschool, the investigator implemented these changes prior to the start of the investigation for the betterment of the environment. The scale was administered a second time by an independent observer during the week of February 23 – 27, 2009. A total mean scale score of a **6.35** was obtained after all of the items scored for the entire scale were summed (Total Subscale Score

= 254) and divided by the number of items scored (Number of Items Scored = 40). The implemented changes amended the environmental rating. Theses changes were not implemented for methodological purposes. Rather than being investigation-driven, the changes were a product of the mutualistic relationship between the investigator and practitioners.

It is particularly important to note that the investigator earned his Bachelor of Science in Special Education from the Peabody College of Education and Human Development at Vanderbilt University in Nashville, Tennessee. Administration and interpretation of the ECERS was taught in several of his pedagogical courses and early childhood practicum. He has been actively using the measure for both research and instructional practice ever since. Regarding instructional practice, he provides instruction on the administration and interpretation of the ECERS in his undergraduate developmental and educational psychology courses. The individual who conducted the second observation for reliability was recruited by the author from his Child Development course at Rider University in Lawrenceville, New Jersey. The second observer received both in-class and one-on-one instruction from the investigator on the use of the measure.

B. Participants

Thirty-six children were selected from a cohort of 51 children enrolled at the preschool. An equal number of boys (n = 18, *M* = 4 years, 22 days, *SD* = 105.31) and girls (n = 18, *M* = 4 years, 8 days, *SD* = 122.29) were selected from the 3-day (Monday/Wednesday/Friday) and 2-day (Tuesday/Thursday) preschool sessions for 3-year-old children. Of the 36 children, 24 children were selected from the 3-day preschool sessions

(MWF am, n = 12; TR am, n = 12) and 12 children were selected from the 2-day preschool sessions (TR am n = 6; TR pm n = 6).

Selection from the 3-day sessions was greater for several reasons. During initial conversations with the classroom teachers, attendance was said, anecdotally, to be better in the 3-day sessions. If there was an absence, the 3-day sessions allowed for an additional "make-up" day. Aside from the issue of attendance, a scheduling/space issue made it difficult to observe more than 6 children from the 2-day sessions. Two church groups, Bible study and Mothers of Preschoolers (MOPS), met in the same space where the sensory table was set. In addition to having one less day to observe, the meetings of these two groups made Thursday observations almost impossible; observation was limited to 45-minutes on Tuesday.

Following the manufacturer's safety guidelines, dyads, and not triads or quadriads, were organized to ensure the comfort and safety of the children who participated in the sensory table activity. After the classroom teachers and assistants had identified every child's preferred playmate, each of the 36 children was paired with a peer from his/her class, creating 18 dyads across the 3-year-old sessions. Three evenly proportioned groups were formed from the 18 total dyads. Two groups had homogeneous dyads (male/male, dyads: n = 6; participants: n = 12, *M* = 4 years, 10 days, *SD* = 98.30; female/female, dyads: n = 6; participants: n = 12, *M* = 4 years, 23 days, *SD* = 114.60) and one group had heterogeneous dyads (male/female, dyads: n = 6; participants: n = 12, *M* = 4 years, 12 days, *SD* = 132.34). The mean peer partner age difference was 75.33 days (*SD* = 43.98) for male/male dyads, 67.50 days (*SD* = 101.88) for female/female dyads, and 121.17 days (*SD* = 103.09) for the male/female dyads. When creating the dyads, peer compatibility, as reported by the

preschool director and teachers, superceded the difference in age. The greater spread in age for the heterogeneous dyads is a matter of happenstance. Equal distribution of sex combinations was possible because over a dozen children were said to have preferred an opposite-sex playmate. Balance occurred naturalistically, so the investigator controlled for it.

Children of this age were selected because observational investigations indicate that the sensory table is a preferred activity for 3 – 4-year-olds (Rubin 1977a, 1977b; Tizard, Philps, & Plewis, 1976). With regard to play behavior, though some simple games with rules are possible at this age, it was anticipated that the participating children would likely engage in constructive and dramatic play in a parallel or social manner; dramatic play is indeed the hallmark of Piaget's preoperational stage of development.

A description of the study and request for children's participation was included in a newsletter sent to parents during the month of August, prior to the start of the school year (see Appendix A). Children's participation in this study was determined by: 1) a returned parental consent form, 2) the availability of a peer within the same preschool session to serve as a "play partner" during the center activity (i.e., another child to complete the dyad), and 3) recommendations from the preschool director and classroom teachers. All of the parents gave their consent. However, 15 children were not selected. Children who were frequently absent, would be on leave for more than 2 weeks of the investigation, and/or could not be matched with a peer were excluded.

Prior to the investigation, parents of participating children were asked to complete a brief sensory experience questionnaire (see Appendix B) that was designed to establish sensory table familiarity and current engagement in sand/water play. The overwhelming majority of parents identified the preschool as the place where their child primarily engaged

in sandbox or sand/water table play (n = 25). Interestingly, while 25 of the children had access to a sandbox or sand/water table at home, the preschool was still identified as the place of primary engagement for 16 of them. Overall, the results of the questionnaire suggested that children's experience was comparable. Even though 11 of the parents identified a place other than school (e.g., home), it is unlikely that these children had recent experience that was much different from the others because of the weather at the time of this investigation. The investigation began in March and no one reported having an indoor sandbox or sand/water table.

Each of the participating preschool sessions received international play food (e.g., breads and "world cuisine") for their housekeeping/dramatic play center in token of appreciation for their participation. These items were chosen in response to the program's *Promoting acceptance of diversity* rating on the *ECERS*. With their newly acquired "cultural cuisine," the program should score a *Good* rating, in subsequence assessments, for this measure of the *Activities* subscale. A poster presented at the 39th annual meeting of the Jean Piaget Society, which outlined preliminary results, was displayed on a bulletin board at the end of the school year. Parents were informed of the general results upon completion of the investigation through a narrative included in the preschool's newsletter. The Holy Cross Lutheran Preschool Board of Directors received a copy of the signed dissertation for their records.

C. Materials

Children were invited to play at an indoor/outdoor sensory table 42" in length, 24 ½" in width, and 24" high. The table's tub is 9" deep. The dimensions of this table afford approximately 5 ½ sq. ft. of play space (i.e., the volume of the tub). Children were presented

with one of four surfaces in the tub of the sensory table: rocks, sand, soil, and water. Equal amounts were added to the tub, filling it 5 ½ ” deep.

One of two clear plastic boxes containing 40 provisions was available for use at the table; it was located to the left of the sensory table on top of a small plastic Fisher-Price table. Though the objects in each box were perceptually similar and matched for function (e.g., digging, pouring, containment), they varied in their realism. Following the specifications of Pulaski (1970), one box was minimally structured and the other highly structured. The minimally structured box contained objects that loosely represented realistic objects and/or were capable of multiple functions. The highly structured box contained objects that had greater realism and/or served only one function. Since prior investigations have shown dramatic play to vary as a function of realism, the sensory table provisions were systematically manipulated to determine if dramatic play occurs with greater frequency at the sensory table when objects afford a variety of themes (i.e., are minimally structured) or are “thematically anchored” and grounded in a specific theme (i.e., highly structured).

The minimally structured object set, derived from the suggested materials list of West and Cox (2001), included: 3 animal cookie cutters, 3 sea animal cookie cutters, 2 small buckets, 4 wooden dowels with painted sphere tops, 1 set of plastic tubes (various sizes), 2 plastic soap dishes, 2 insect cookie cutters, 1 set of spoons in assorted sizes, 2 small plastic mixing bowls, 2 snack-sized Ziploc bags with beans, 4 doll clothespin painted people, 4 wooden 2-dimensional seashells, 2 small plastic shovels, 2 plastic sifters, 2 rectangular sponges, 2 wooden block shaped vehicles, and 2 plastic cups. The highly structured object set, also derived from the list of West and Cox (2001), included: 3 animal figures, 3 sea animal figures, 2 plastic flower pots, 4 plastic/silk flowers, 1 funnel set, 2 small boats, 2

insect figures, 1 set of measuring spoons, 2 small cake pans, 2 packets of seeds, 4 *Disney's Little Einstein* figurines, 4 seashells, 2 small garden shovels, 2 flour sifters, 2 fruit-shaped sponges (one apple, one eggplant), 2 small vehicles (one Dodge Magnum RT, one Mercedes-Benz C-Class), and 2 small watering cans.

The investigator designed a *Functional Object Rating* (*FOR*) to establish a structural difference between the two object sets. Thirty-seven undergraduate students from Rider University were recruited from two psychology classes to complete the rating of the provisions. The rating was offered as an extra credit opportunity and administered at the start of each class. All of the students who were in attendance during those sessions chose to participate.

Microsoft PowerPoint was used to format and present the *FOR*. Introductory slides were devoted to the instructions, followed by examples, and then the objects to be rated. Students were told that they would see 17 pairs of objects that were perceptually similar (e.g., color, shape), but different in function and/or realism (e.g., 4 wooden dowels with painted sphere tops vs. 4 plastic/silk flowers). They were asked to rate each object from the pair according to a 5-point scale that assessed structure (see Appendix C). A rating of a "1" indicated a *flexible* object, one that has multiple uses and/or loosely resembles a real object. A rating of a "5" indicated a *rigid* object, one that has a specific use and/or appears very realistic. Two pictures appeared on each slide, the minimally structured object(s) and its/their corresponding highly structured counterpart, on the left or right side of the slide under the heading "Set #__." The investigator announced the set number then labeled each of the pictures using the aforementioned object set lists (also found in Table 1). Pictures remained on the screen for approximately 1 minute. Objects were pictured singly on a muslin

sheet. Picture order was randomized so that items of the same structure did not always appear on the same side of the slide.

Ratings were summed and averaged by object set. Only completed ratings were included in the final sample; two *FORs* were excluded because they were incomplete. Overall, the highly structured object set scored a 4.00 rating (SD = .63) and the minimally structured object set scored a 2.31 rating (SD = .60). The highly structured object set was found to be significantly more rigid and realistic than the minimally structured object set, t (34) = 10.921, $p < .001$. Moreover, the rating was effective in establishing a reliable difference in the structure of the realism of the two object sets.

The various objects were provided for the purpose of manipulation, exploration, and play at the sensory table. Table 1 lists the provisions of the minimally structured object set and corresponding highly structured object set. Tables 2 – 6, following the themes of West and Cox (2001), suggest the possible surface-provision combinations and themes that were likely to emerge. Sessions were videotaped with a Sony Mini DV Digital Handycam and scored after collection.

Concerning its positioning, the sensory table was horizontally sandwiched between the small Fisher-Price table and a wall. From the child's perspective the Fisher-Price table was on the left, sensory table in the middle, and wall on the right. The digital camcorder was positioned approximately 5' away from the sensory table and opposite the children. Collectively, the height of the tripod, tilt of the camera, and angle of the camera view allowed for a full, unobstructed scene of the children, sensory table, and its contents. Again, from the child's perspective, the camera was positioned slightly left of the center of the table, which provided a partial view of the Fisher-Price table where the object set box was placed.

The space was purposefully arranged for optimal video recording. By limiting access to one side of the table, the children were always on camera and no behaviors were missed.

D. Procedure

Children's behavior at the sensory table was observed during routine center time. Each 3-year-old class session is 2 ½ hours long with 1 hour in the schedule allocated to center time. In addition to the sensory table, the following activity centers are available for the children during center time: art, blocks/manipulatives, dramatic play, problem-solving/puzzles, and quiet reading. Children in the 3-year-old classes select their own activity and are not required to rotate through all of the independent activity centers during the 1-hour period (i.e., round-robin). The availability of six activity centers during scheduled center time allows for 10 minutes of play at each of the centers; this assumes that children will choose to visit each activity center and distribute their time equally.

As a quasi-naturalistic study, investigator-selected dyads were invited to play at the sensory table and observed for 5-minutes. Though they were only observed for 5-minutes, the activity generally took about 10-minutes, which provided children with 50-minutes for interaction and play at the other activity centers during center time. Sessions usually started with a trip to the restroom and/or the rolling up of sleeves. To encourage good personal hygiene, rock, sand, and soil trials ended with a trip to the restroom to wash hands.

Observations were scheduled for 15-minute intervals during center time (e.g., :00, :15, :30, :45) with up to 4 dyad observations in a Monday/Wednesday/Friday class period; up to 3 dyad observations were scheduled for a Tuesday/Thursday class period because of the smaller number of selected dyads. Four observations per session was ideal, but 3 observations per session was more common because of attendance and clean-up. A 5-minute

clean-up transition was not always possible. The transition between observations could take anywhere from 2- to 15-minutes depending on the objects and/or surface. With dirt, for example, objects would have to be washed and dried between uses. On several occasions, because of absences, the investigator had to switch the contents of the tub between trials, which was also time consuming (e.g., removing 150 lbs of sand from the tub and adding 150 lbs of soil to it). To control for potential rebound and fatigue effects from the previous and current activity, respectively, the observation schedule (i.e., time order) was counterbalanced across dyads within a particular classroom (see Tables 7 – 10). All observations began at the start of center time, regardless of the number of participating dyads from the class. If one or both children from the dyad were absent on the scheduled observation day, it was rescheduled for the next day on which both children were in attendance.

The study used a three-factor design (4 x 2 x 3) in which behavior was compared across surface (i.e., rocks, sand, soil, and water), provision set (i.e., minimally structured and highly structured), and dyad (male dyads, female dyads, and mixed dyads) to evaluate the effect of surface and materials on preschoolers' play forms (i.e., functional, constructive, dramatic, and games-with-rules) and contexts (i.e., solitary, parallel, and social). As previously described, each of the 36 children was paired with a peer from his/her class, creating 18 dyads across the 3-year-old sessions. Three evenly proportioned groups were formed from the 18 total dyads. Two groups had homogeneous dyads (i.e., male/male, n = 6; female/female, n = 6) and one group had heterogeneous dyads (i.e., male/female, n = 6). Dyads remained constant throughout the study.

A novel surface and one of the two provision sets was introduced weekly to each dyad once a week for eight weeks without repetition. Eight observations were made for each dyad, one for each surface-provision set combination. At the start of each observation the investigator familiarized the dyad with the provisions in the plastic container. No instruction was given as to how to use the items; the investigator simply pointed to each item and labeled it. Items were compartmentalized in the plastic container and always presented in the same arrangement. Once all of the supplies had been identified, the investigator removed the lid of the sensory table to reveal the surface. Following the reveal, the investigator pointed to the surface and labeled it. Dyads then had 5-minutes of unfettered playtime at the sensory table. Trials began the moment a child touched the surface with or without an object. During the trial the investigator spoke only when necessary. When he did, which was seldom, he refrained from using verbs (i.e., describing actions) and limited the scope of his dialogue to nouns and adjectives, labeling the supplies and surface. Moreover, encouraging verbal prompts or gestures that could contribute to the observed exploration behaviors were not used.

Observations were conducted in a quiet multipurpose room adjacent to the classroom; this is where the sensory table was set up and maintained. Surface and provision presentation order was counterbalanced across the four 3-year-old sessions (i.e., all of the dyads from one session were in the same order; see Tables 11 – 12). Order was not counterbalanced across the dyads because the weight of the surfaces (e.g., 150lbs of sand and soil, 200lbs of rocks) and time needed for transition made this a physical impossibility for one investigator who needed to observe as many dyads as possible in a 1-hour period. The sensory table was only available to children during their scheduled time at the center with the investigator. The

preschool teachers did not plan or design any activities involving the sensory table for the duration of the study.

E. Scoring

Children's behavior at the sensory table was scored in accordance with pre-established play forms (i.e., type of play) and contexts (i.e., social participation). Following Rubin's (2001) *Play Observation Scale* (POS), the duration of behavior was recorded every 10-seconds (to the nearest 5-seconds) of the 5-minute observation, for a total of 30 intervals per trial. The operational play form definitions were taken from Smilansky (1968) and included functional, constructive, dramatic, and games-with-rules. *Functional play* is characterized by aimless motoric activity with or without an object, involving movement that is both simple and repetitive. Examples of functional play behavior at the sensory table included moving a hand through the sand, pushing a sponge back and forth in the water, or using a plastic cup to fill and dump rocks.

Constructive play is both creative and goal-directed. Object use is a requisite for this play form as the consequence of using available object(s) and/or material(s) is to build, form, or "construct" an intended or desired item. Children's constructive behavior included using the buckets to build a sandcastle in the sand, tilling the soil with a shovel to plant flowers and seeds, and making a path for cars. Constructive play was scored episodically; in addition to the product, the means to an end were also recorded as constructive behavior. For instance, when one child used the plastic soap dish and seeds to make a rattle, the opening of the box, arrangement of the seeds, and closing of the box were scored as constructive behaviors for they were the necessary steps to achieve the desired goal of making a musical instrument.

Dramatic play is a comprehensive form inclusive of all pretense activity. Examples of dramatic play included baking cupcakes and making sandwiches with the cups and bowls, taking the people figures swimming in the pool (i.e., water), and using the watering can to pour pretend water on the soil. Dramatic play was scored conservatively; only clearly observable instances articulated through language, gesture, and play sounds were scored, no inferences were made about its possibility. With the aforementioned cupcake and sandwich example, the child would have had to say that he/she was preparing the dish and/or make a cooking sound (e.g., "I need to bake my cupcakes in the oven," "We need a little pinch of sugar, " or making the sound of milk/water pouring). The scooping of soil into a cup and bowl without language or play sounds would be scored as functional play. Pouring pretend water from the watering can is an example of a dramatic gesture. A play sound was defined as the attribution of a non-language utterance to an object (e.g., a "squealing" pig, the "vroom" and "crash" of a car, or the "buzzing" of a ladybug). Collectively, these three characteristics were used to distinguish dramatic from functional play.

Games-with-rules play is a competitive competition between two or more children governed by pre-established principles and procedures. Based on his interpretation of the suggested activities in the practitioner literature (e.g., Herr & Larson, 2009; West & Cox, 2001), the investigator reasoned that some simple games would emerge from the surface-provision set combinations, such as a boat race (i.e., in a best of three successive trials, the children synchronize their push and release of a boat in the water to see whose boat reaches the other side first) or hide and seek (i.e., hiding the animal figures in the rocks to see who can find and dig up the most). Only one game was observed. Using bowls from the

minimally structured object set, two boys entered into a "bowl filling competition" to see who could fill up his bowl with rocks first.

The operational play context definitions were modified from Parten (1932). They included solitary, parallel, and social play. *Solitary play* was used to describe the engagement of a child within the dyad whose behavior occurred irrespective of his/her peer (i.e., individual/nonsocial play). *Parallel play*, like solitary play, was also independent and nonsocial, however the children were observed to have corresponding actions. Traditionally, researchers distinguish between solitary and parallel play with an operational definition that also includes a distance measure that refers to the proximity of other children. The size of the sensory table and nature of this activity center inhibited such distinction because in essence the children were always playing side-by-side (i.e., *parallel play*). As previously described, the quality of the dyad's actions differentiated solitary from parallel play. *Social play* was used to describe the engagement of both children in a shared experience at the sensory table. In addition to conversation, gestures (e.g., high-fives), joint laughter, and smiles that occurred within the context of play were scored as social.

Following Rubin, Maioni, and Hornung (1976), the duration of each child's play form and the social context in which it occurred were recorded simultaneously. This method of observation has been described as "nesting" Smilansky's (1968) play forms in Parten's (1932) social participation categories (see Johnson & Ershler, 1981; Pellegrini & Perlmutter, 1989; Rubin et al., 1976; Rubin, Fein, & Vandenberg, 1983). For example, if one child from the dyad pushed a sponge back and forth in the water the behavior was classified as *solitary-functional*. When two girls were observed making *Chick-fil-A* meals together in the dirt their behavior was classified as *social-dramatic*.

Traditionally, three of the possible twelve play context-form combinations are not scored because of their operational definitions. *Games-with-rules* must involve two or more children and is therefore inherently social. It is not a common practice to identify children's behavior as *social-functional* because the shared experience of social play requires a common goal and functional play lacks intent. However, within the context of this activity, the investigator observed play that conformed to the operational definitions and could not be classified as anything else. *Social-functional* play at the sensory table was defined as a shared playful experience that lacked purpose and exemplified in activities such as joint laughter while splashing each other with water and conversation during aimless shoveling (e.g., moving sand around together without actually making anything).

Each recorded session was viewed three times. The first viewing served as a familiarization. Instead of immediately scoring children's individual action units on an interval-by-interval basis, familiarization allowed the observer to understand each child's behavior in terms of overarching play goals. For example, during each 10-second interval filling a bucket with sand can appear functional, but if a child levels the sand after filling the bucket to the top, flips the bucket over, and puts a shell on top of her "sandcastle," the behavior is then constructive. The construction of this sandcastle may take several 10-second intervals (e.g., 18 = 3 minutes), so understanding the intention behind her action renders the episode more easily scored. In other words, instead of scoring the first 2 minutes of bucket filling as functional play and having to rewind the tape and erase the coding sheet the moment the sandcastle is constructed, the observer would have understood the individual actions (i.e., digging, scooping, and dumping) as purposeful steps because of the familiarization. The behavior of each child from the dyad was then scored individually

during the second and third viewing, one viewing for each child; observers did not score a dyad composite.

The same initial observer scored all behaviors for the entire sample and a second observer conducted reliability testing on 49% of the observations (n = 8,520 intervals). For each of the 8 weeks, 9 of the 18 weekly observations were randomly selected for reliability scoring using the "List Randomizer" function on the random.org webpage. Due to investigator oversight only 8 observations from week 7 were scored for reliability; this resulted in the scoring of 71 total observations, which is one short of half. Overall, the second observer scored 7,060 intervals (83%) with the same play form and context as the initial observer. When parsed, 3,543 (83%) play form intervals and 3,517 (83%) context intervals were synonymous. The obtained reliability is within Rubin's (2001) reported 80 – 90% range, which is based on over 50 studies noted in the bibliography of the *Play Observation Scale*.

F. Perspective of the Investigator

Due to the methodological design, the investigator gradually assumed the role of a quantitative-insider at the preschool. His initial steps in conducting the investigation were cordial and divorced. Prior to the start of this investigation, in the fall of 2008, the investigator made passing weekly visits to each of the preschool classes to become familiar with the children, practitioners, and setting, observe daily routines, and administer the ECERS. However, once the investigation began, methodological demands required the investigator to be at the preschool full-time, Monday through Friday. To avoid classroom interruption and ensure activity timeliness, the sensory table was setup prior to the children's arrival, from 8:00 am to 9:00 am, and cleaned up after their departure, from 3:00 pm to

4:00 pm. As a result of his hours, he ultimately became an active participant in the daily routines at Holy Cross. He would greet parents upon arrival, participate in circle time and snacks, play with the children on the playground, and commonly lead end of the day music and movement activities. Moreover, he would lead the class when one of the primary teachers was absent. Overall, his role at the preschool is best described as that of a classroom teacher. He welcomed this role, as it was always his intent to establish an open, mutualistic relationship with the children, parents, and staff at Holy Cross.

G. Data Analysis

The surfaces, provision sets, and dyad combinations were the variables that were manipulated by the investigator (i.e., independent variables); play forms and contexts were the behaviors of interest that were measured (i.e., dependent variables). Dyad was used as the unit of analysis. Following Rubin's (2001) *Selecting the Dominant Behavior* procedure, which is outlined in the *POS*, a dyad composite score was created for every 10-second interval (n = 60 intervals per trial (30 play forms and 30 social contexts) x 8 observations x 18 dyads = 8,640) of the 144 trials using the observed behaviors from each contributing child of the dyad. The dyad composite score represents the most mature play form (functional < constructive < dramatic < games-with-rules) and social context (unoccupied < solitary < parallel < social) that was expressed during the interval. For example, if one child engaged in solitary-constructive play and the other in solitary-functional play during a 10-second interval the interval would be scored as a dyadic solitary-constructive. Individuals could not be used as the unit of analysis because of interdependence; the children shared both the provisions and play space. Moreover, because of the design of this investigation, the social context measures were inherently interdependent. The scoring of one child as engaged in

solitary, parallel, or social play was contingent on the nonsocial behavior, corresponding action, or interaction of the other child, respectively.

Scored trial intervals were converted to minutes (e.g., 30 intervals per trial x 10 seconds per interval = 300 seconds / 60 seconds per minute = 5 minutes). This cumulative time duration, reported in minutes, was the value that was entered into the analyses.

CHAPTER III

RESULTS

A. Independent Play Form, Context, & Nested Play Analyses

Each play form (functional, constructive, dramatic), context (solitary, parallel, social), and nested play form-context combination (e.g., solitary-functional, parallel-constructive, social-dramatic) was analyzed with a 4 (surface) x 2 (object) x 3 (dyad) repeated measures ANOVA. Games-with-rules was not analyzed because it only occurred once. Statistical analyses were run in PASW Statistics (formerly SPSS) and Stata; the latter was used specifically for the analysis of three-way interactions. Post-hoc analyses using pairwise comparisons with Bonferroni corrections ($p < .05$) were conducted to interpret surface effects.

Surface, object, and interaction effects were parsed and are delineated below. There were no significant main effects, interactions, or marginal effects for social-dramatic play. Tables 13 – 27 present the mean durations for all independent and nested play categories. Figures 1 – 10 graphically present the consolidated mean durations (i.e., both object sets) for play behaviors that were significantly affected by the surface of the sensory table.

B. Effect of Surface on Sensory Table Play

Like the anecdotal observations of non-human animals' play and empirical investigations on infants' exploration of materials, the results of this investigation with preschoolers suggests that surface is indeed an ecological factor with the power to effect play behavior. Both the independent and nested play analyses showed that the available surface type at the sensory table influenced preschoolers' behavior, leading to different forms and contexts of play. Regarding the independent play form and context analyses, differences

were found for functional (F (3, 45) = 14.688, $p < .001$), constructive (F (3, 45) = 19.409, $p < .001$), dramatic (F (3, 45) = 3.503, $p < .05$), and social play (F (3, 45) = 2.423, $p = .078$). Water pulled for the most functional play ($M = 2.685$, $SD = .852$; all p's $< .01$). When playing with water children spent the majority of their time (54% of the session) engaged in aimless activity. Conversely, children engaged in significantly less functional play with the sand (27%; $M = 1.357$, $SD = .861$), soil (31%; $M = 1.560$, $SD = 1.227$), and rocks (40%; $M = 1.991$, $SD = .858$). Though it was not different from soil, overall, sand pulled for the most constructive play. Construction was greater with the sand (43%; $M = 2.171$, $SD = .897$) than both water (11%; $M = .561$, $SD = .531$; $p < .01$) and rocks (27%; $M = 1.366$, $SD = .900$; $p < .05$); constructive play with soil (41%; $M = 2.065$, $SD = 1.101$) and rocks was also greater than water (all p's $< .01$). While no single surface was found to pull for the most dramatic play, pretense did occur more often with water (25%; $M = 1.259$, $SD = .716$; $p = .01$) than rocks (15%; $M = .736$, $SD = .550$). Social play was the only independent context that had an effect, albeit marginal, of surface; more interactions tended to occur with sand (24%; $M = 1.204$, $SD = .757$; $p = .054$) than water (18%; $M = .879$, $SD = .669$).

For the nested play analyses, differences were found for solitary-functional (F (3, 45) = 12.349, $p < .001$), solitary-constructive (F (3, 45) = 10.508, $p < .001$), parallel-constructive (F (3, 45) = 10.350, $p < .001$), parallel-dramatic (F (3, 45) = 3.018, $p < .05$), social-functional (F (3, 45) = 4.561, $p < .01$), and social-constructive play (F (3, 45) = 12.073, $p < .001$). Although it was not different from rocks, overall, water pulled for the most solitary-functional play (36%). Aimless solitary behavior was greater with the water ($M = 1.824$, $SD = .831$; all p's $< .05$) than both sand (17%; $M = .861$, $SD = .663$) and soil (20%; $M = 1.014$, $SD = .803$); solitary-functional play with rocks (28%; $M = 1.422$, $SD = .612$; $p < .05$)

was also greater than sand. Moreover, though there was no difference between sand and soil, overall, sand pulled for the least solitary-functional play. Significantly more solitary-constructive play was observed with sand (19%; $M = .959$, $SD = .509$), soil (23%; $M = 1.158$, $SD = .821$), and rocks (17%; $M = .829$, $SD = .611$) than water (5%; $M = .273$, $SD = .312$; all p's $< .01$). While no single surface was found to pull for the most social-functional play, interactions involving aimless activity did occur more often with water (6%; $M = .297$, $SD = .255$; $p < .05$) than sand (2%; $M = .120$, $SD = .141$). Though it did not differ from soil, overall, sand pulled for the most parallel-constructive and social-constructive play while water pulled for the least. Children were observed to have more corresponding constructive behaviors when playing with the sand (8%; $M = .422$, $SD = .309$) than the water (2%; $M = .083$, $SD = .114$) and rocks (4%; $M = .180$, $SD = .241$; all p's $< .05$); parallel-constructive play with soil (6%; $M = .283$, $SD = .287$; $p < .05$) was also greater than water. Joint construction was greater with the sand (15%; $M = .732$, $SD = .541$) than water (4%; $M = .205$, $SD = .285$; $p < .01$) and rocks (7%; $M = .357$, $SD = .359$; $p = .01$); social-constructive play with soil (12%; $M = .579$, $SD = .629$) was also greater than water ($p < .01$) and trending in this direction for rocks ($p = .05$). Parallel-dramatic play was the only nested play behavior with a marginal effect of surface, which was revealed in post-hoc analyses; corresponding pretense tended to occur more often with water ($M = .213$, $SD = .288$, $p = .10$) than rocks ($M = .065$, $SD = .123$).

C. Effect of Object on Sensory Table Play

As predicted, play and social participation at the sensory table were influenced by the structure of the provided objects. Collectively, the independent and nested play analyses suggest that the highly structured toys pulled for the most mature cognitive play form while

the minimally structured toys pulled for the most sophisticated social context. The highly structured toys, with realism that lent to specific themes, appear to have functioned as a thematic anchor and cultivated a greater occurrence of dramatic play as compared to the minimally structured objects (F (1, 15) = 10.592, $p < .01$; highly structured object set: $M = 1.227$, $SD = .649$, minimally structured object set: $M = .789$, $SD = .690$), which pulled for more functional play (F (1, 15) = 37.504, $p < .001$; minimally structured object set: $M = 2.239$, $SD = .971$, highly structured object set: $M = 1.558$, $SD = .677$). Moreover, functional play was greater with the minimally structured object set across all three of the social contexts in which it was nested (solitary-functional: F (1, 15) = 5.881, $p < .05$, minimally structured: $M = 1.422$, $SD = .737$, highly structured: $M = 1.139$, $SD = .504$; parallel-functional: F (1, 15) = 26.589, $p < .001$, minimally structured: $M = .570$, $SD = .471$, highly structured: $M = .269$, $SD = .253$; social-functional: F (1, 15) = 7.204, $p < .05$; minimally structured: $M = .243$, $SD = .202$, highly structured: $M = .146$, $SD = .142$).

The realistic domestic materials, figurines, and vehicles in the highly structured toy set were expected to increase the amount of social play, however, they tended to pull for more solitary behavior (F (1, 15) = 4.256, $p = .057$, highly structured: $M = 2.965$, $SD = .613$, minimally structured: $M = 2.614$, $SD = .895$); solitary-constructive (F (1, 15) = 9.596, $p < .01$, highly structured: $M = .935$, $SD = .514$, minimally structured: $M = .674$, $SD = .348$) and solitary-dramatic play (F (1, 15) = 14.570, $p < .01$, highly structured: $M = .790$, $SD = .435$, minimally structured: $M = .482$, $SD = .480$) were indeed increased with this set. Furthermore, it was the minimally structured toy set, containing objects that loosely represented realistic objects and/or were capable of multiple functions, that fostered a greater amount of socialization through corresponding actions (i.e., parallel play: F (1, 15) = 6.978,

$p < .05$, minimally structured: $M = .942$, $SD = .585$, highly structured: $M = .678$, $SD = .355$), interactivity (i.e., social play: $F\ (1, 15) = 5.569$, $p < .05$, minimally structured: $M = 1.143$, $SD = .888$, highly structured: $M = .924$, $SD = .630$), and, when nested, social-constructive play ($F\ (1, 15) = 5.024$, $p < .05$, minimally structured: $M = .549$, $SD = .488$, highly structured: $M = .387$, $SD = .376$).

D. Surface, Object, & Dyad Interactions

When two preschoolers are at the sensory table it appears that in some instances their play may be a product of the interaction between the surface type, provided objects, and playmate dynamic. While the individual and nested play analyses did not reveal any significant interactions for the homogeneous dyads, effects were found for the heterogeneous dyads with respect to constructive ($F\ (6, 45) = 3.852$, $p < .01$), parallel ($F\ (6, 45) = 2.397$, $p < .05$), solitary-constructive ($F\ (6, 45) = 5.407$, $p < .001$), and parallel-functional play ($F\ (2, 15) = 6.505$, $p < .01$). Generalized tests of simple main effects, using the per family error rate ($p < .05$), were used as post-hoc analyses in order to explore the nature of the interactions. Coupling sand with the highly structured object set augmented heterogeneous dyads' constructive play (analysis of object x dyad interaction at each level of surface, $F\ (2, 45) = 6.726$, $p < .05$; analysis of object at each level of dyad holding sand constant, $F\ (1, 45) = 7.005$, $p < .05$) and, specifically, their solitary construction (analysis of object x dyad interaction at each level of surface, $F\ (2, 45) = 10.998$, $p < .01$; analysis of object at each level of dyad holding sand constant, $F\ (1, 45) = 22.374$, $p < .01$). Conversely, pairing sand with the minimally structured object set increased their parallel play (analysis of object x dyad interaction at each level of surface, $F\ (2, 45) = 6.652$, $p < .05$; analysis of object at each level of dyad holding sand constant. $F\ (1, 45) = 11.241$, $p < .01$). Further, the

heterogeneous dyads engaged in more parallel-functional play (M = .930, SD = .522) than the homogeneous male-male dyads (M = .209, SD = .074) when the minimally structured object set was provided (analysis of each level of object, F (2, 15) = 5.297, $p < .05$; post-hoc analyses using pairwise comparisons with Bonferroni corrections, p = .015).

E. Non-Play Behavior

Play dominated the sessions. Only a negligible amount of time was spent engaged in non-play behavior. Dyads, on average, were transitioning, preparing their materials for play, and unoccupied for less than 10 (M = 0.14 minutes, SD = 0.10) and 20 seconds (M = 0.31 minutes, SD = 0.17) per trial, respectively.

CHAPTER IV

DISCUSSION

A. Suggestions for Early Childhood Education Practitioners

If early childhood education practitioners plan on using the sensory table to achieve cognitive and social domain objectives, then both variety (e.g., physical diversification and functionality; see Harms et al., 2005) and pull must be considered. Further, the findings of this investigation suggest that the planning of domain-specific learning objectives should precede the selection of provisions. When the sensory table is planned for the achievement of fine motor and adaptive domain objectives, practitioners will likely find water to be the most suitable surface. Aimless sensorimotor activity (i.e., functional play) in water can foster object manipulation, which may improve dexterity for prewriting objectives, and pouring (for learning objectives see Bricker & Pretti-Frontczak, 1996).

Pouring is an essential mealtime ability; a child could practice pouring, without spilling, using various containers and cups in the water (i.e., minimally structured objects). Upon mastery, this adaptive skill could then be further developed within the context of other daily routines. Since water was found to pull for the most solitary-functional play, this adaptive skill could be practiced independently at the sensory table and socialized through conversational exchanges during meal and snack time. For example, the child could approach each of his/her preschool friends, ask if he/she would like juice, and pour for those that would like some. Conversational exchanges could include a "yes, please" and "thank you" (after successful pouring) from the preschool friend and "you're welcome" from the child who pours. Though it was found to pull for the least sophisticated cognitive play form,

the aforementioned instructional suggestion for water exemplifies how it can be used to achieve specific domain objects and foster the development of others.

If the sensory table is intended to achieve cognitive objectives, then practitioners will likely find sand and highly structured objects to be best. Constructive play with sand, in conjunction with minimally or highly structured objects, can promote initiation, engagement, and completion of age-appropriate activities, proper use of materials, and problem solving abilities (for learning objectives see Bricker & Pretti-Frontczak, 1996). With respect to the first two learning objectives, the preschoolers in the current investigation were observed to build castles, roads, and towers, bury and conceal objects, and plant flowers and vegetables in the sand without adult direction or guidance. Though the investigator labeled the objects, no instruction or demonstration was given for their proper use; construction of intended items was achieved though the ingenuity of the individual child or dyad (e.g., using the animal cookie cutters to make shapes in the sand). Together, these two learning objectives highlight sand's potential to cultivate problem solving through strategy development (e.g., constructive planning) and the use of available means to achieve a specific goal.

Whenever dramatic play is the objective, highly structured toys are needed to encourage it. Though early elementary school-aged children appear to benefit from minimally structured toys (Pulaski, 1970), it appears that highly structured toys are advantageous for preschoolers for they act as a thematic anchor (see also Fields' thesis study, as cited in Rubin et al., 1983). This can be exemplified in the present investigation through the comparison of the animal cookie cutters and figures. While the animal cookie cutters could have been used both constructively and dramatically, the latter was rarely observed; the

preschoolers used the animal figures for themes and storylines (e.g., using the sea animals to have an "under the sea" adventure in the sand).

Recommendations for social objectives are not as clear. Typically, domestic materials, figures, and vehicles, like those in the highly structured object set, are found to increase the amount of social play (see Parten, 1932; Rubin 1977a, 1977b; Vandenberg, 1981), however, the pull for more solitary behavior, both constructive and dramatic, suggests that the novelty of these objects may have detracted from it. Obtained social results seem to agree with this finding; parallel, social, social-functional, and social-constructive play were indeed greater with the minimally structured object set. Perhaps the novelty and realism of the highly structured objects superseded interaction with a familiar peer while the simple, minimally structured, objects pulled for more interaction because the peer became the object of greater interest.

Heterogeneous dyads seemed to be especially affected by this. When playing in sand, a preoccupation with the highly structured objects and actions of one's playmate with the minimally structured objects may have driven solitary constructive and parallel play, respectively. Parallel-functional play was indeed greater for the heterogeneous dyads, as compared to the homogeneous male-male dyads, with the minimally structured object set, which further suggests a greater interest in the peer's use of simple provisions. The aforementioned structural interpretation seems to coincide with the findings of Eckerman and Whatley (1977), who found social communication to be hampered by the presence of toys and promoted in their absence. Though objects were always provided for play, the highly structured objects may have appeared more "toy-like," pulling for dramatic play, whereas the minimally structured were seen less so and used more functionally and hence, more social.

Social objective recommendations are further complicated by the experimental design of this investigation. It was the intent of the investigator to provide the preschoolers with an unfettered center time activity center experience that was akin to the other available centers where free play was not observed. Aside from labeling the objects and introducing the surface, the investigator did not want to intervene in any way that might disrupt the quasi-naturalistic experience. To achieve this, the object sets were purposefully assembled to promote positive affective interactions. Specifically, though they may have differed in color or form, at least two of each object type was provided in the set to reduce the possibility of negative affect (e.g., disputes over toys), which may have necessitated investigator involvement. For this reason, it is likely that social play would have been greater if there were fewer objects and no duplicates as the present design may have inherently pulled, overall, for more solitary and parallel play. If cooperation can be affected by the absence of materials that would encourage it (see Vandenberg, 1981), then it seems reasonable to assume that it could also be affected by an abundance that renders cooperation and sharing unnecessary. For instance, instead of providing two flower pots, two packets of seeds, two shovels, and 4 plastic and silk flowers, perhaps one flower pot and packet of seeds would have encouraged joint "gardening."

Collectively, practitioners who intend to use the sensory table to achieve social and social-communicative learning objectives should consider the effect of both realism and quantity of provisions. Social play is clearly possible; it is a matter of tuning the provision arrangement. Mere peer proximity does not appear to facilitate interaction. If it did, social play durations would have been higher. Even when they were within 1-foot of each other,

preschoolers engaged in solitary play. The need to share resources, along with proximity, would likely increase interactivity at the sensory table.

One general recommendation for practitioners is to consider learning objectives in relation to what the surface and provisions afford both physically and thematically. Water's pull for more functional play can easily be attributed to its physical state; as a liquid, it is difficult to use water in a constructive way. Substituting snow or ice for water would likely result in more construction because the substance would lend itself to it (e.g., building igloos or snow people). Moreover, like sand and soil, the provided objects could then be used in concert with the surface to manipulate the substance for one's intended purpose. Water castles are not easily constructed with buckets and water, but winter snow castles are possible with the same provisions if the physical state is changed.

A thematic affordance refers to the potential storylines that may emerge from the provisions and can be used to explain the difference in dramatic play between water and rocks. The sensory table was rarely observed to take on a new identity when it was filled with rocks, but it did with water. Rocks were generally used for substitution (e.g., a rock is used as a sandwich), not as a new land or place (e.g., a construction site or Mars). As a whole, the center would become an ocean, swimming pool, or kitchen sink when filled with water. Though both surfaces did afford dramatic play, water may have provided a contextual narrative.

Consideration of thematic affordances may be particularly important when potential themes are not made known to preschoolers, like in this study, and are expected to naturalistically emerge. Dramatic play may be curbed if the pretense possibilities of the surface and objects are not clear. With the rocks, after seeing the provisions, some

preschoolers may have lacked the insight necessary to develop a dramatic scenario based on the ecological arrangement. To increase dramatic play with the rocks, a triceratops and stegosaurus, bulldozer and cement mixer, and space shuttle and astronaut, would likely have fostered dinosaur, construction worker, and space themes, respectively (West & Cox, 2001). The objects in the current provision sets did not appear to be enough to promote animal habitat, aquarium, and baking/cooking themes with the rocks.

Aside from provision modification, it is plausible that additional time would also cultivate dramatic scenarios. The preschoolers in this investigation had one 5-minute experience with each object-surface combination. Although some children regularly engaged in dramatic play, sometimes within the first few seconds, and appeared uninfluenced by the time constraint, others might have benefited from unrestricted playtime. With additional time more sophisticated play themes may have emerged on account of greater familiarity with the provisions. Time does not have to be limited to the center time of one class session. Preschools, like Holy Cross, typically rotate their materials weekly. Weekly availability of a particular sensory table arrangement would support the return to particular play themes and, perhaps, allow children to further develop them across several class sessions. Provision tweaking and time allotment certainly require additional empirical consideration.

B. General Discussion

Providing early childhood practitioners with practical instructional recommendations that could be used for the tailoring of sensory table provisions to specific learning objectives was a central aim of the present investigation. One cannot provide recommendations without discussing the matter of reliability and generalization. With regard to the provisions, all of the objects and surfaces were purchased at local craft, hardware, and toy stores. None of the

minimally structured objects were custom made. The wooden dowels with painted sphere tops, for example, were assembled with a hot glue gun and painted by the investigator using supplies that were purchased at a local arts and crafts store. There was nothing unique about any of the objects. Practitioners can easily obtain the items used in this investigation for use in their own classrooms.

The role of the investigator in this investigation and at the preschool must also be noted. The success of this investigation, defined in terms of no participant reactivity and all 144 observations being conducted, is largely attributed to his immersion in the preschool and the mutualistic relationship that had been established with the children, parents, and staff at Holy Cross. Aside from creating the dyads, the sensory table experience was very naturalistic. The results should not be viewed as free play in the presence of a preschool visitor, but rather as free play behavior under practitioner supervision during centers.

Regarding generalization, the preschool did receive a high rating on the ECERS, however, peer compatibility and child preference, and not overall program quality, will likely determine how applicable the results are to individual preschool classrooms. The classroom teachers conducted a post-observation interview with each of the children one week after their final play session (see Appendix D). Each child was invited to sit alongside of the teacher at one of the activity tables. While seated at the table, the teacher randomly presented five pictures of the classroom, each depicting a regular center time activity (e.g., play table, kitchen, reading center, puzzles, block area). First, she asked the child which activity was his/her favorite and then asked whom he/she wanted to play with at that center. Twenty children selected the play table as their favorite activity and 19 identified their assigned playmate as the person they would like to play with. Further, 12 children selected

the play table as their favorite activity and identified their assigned playmate as the person that they would most like to play with. All 6 children from the Tuesday/Thursday morning class selected the play table and their assigned playmate, which suggest that pairings for this class were especially ideal. Overall, results of this interview confirm previous findings (Rubin 1977a, 1977b; Tizard, Philps, & Plewis, 1976) and suggest that the sensory table is indeed a preferred activity for children of this age. Moreover, it appears that most of the children were paired with someone whom they enjoy playing with. Comparable interests and peer compatibility would likely yield similar results in other classrooms.

Accompanying the aim of providing practitioners with instructional recommendations was the intent to answer the repeated call for more research on children's free play behaviors with an investigation that built wholly on Smilansky's (1968) cognitive play forms and Parten's (1932) social participation categories. From the vast scope of the play literature, ecological factors, such as available materials and objects, was specifically targeted to address proposed concerns regarding methodological practices. Assumptions about material effects were questioned due to a lack of controlled experimental manipulation (Rubin, Fein, & Vandenberg, 1983) and potential confounding with individual play preferences (Krasnor & Pepler, 1980). Either, or perhaps both, of these queries may certainly apply to previous findings for the sensory table as the results of the present investigation have found it to be more than a non-social functional activity. Though insightful for practitioners, what this investigation truly suggests is that a more rigorous approach to the study of children's free play is necessary for generalizations.

Ecological and methodological consistency are essential if we strive to draw generalizations about children's free play behavior; neglecting one or both would surely

render results context dependent. When investigating children's free play behavior researchers should conduct an overall ecological assessment of the observational context and thoroughly describe the available provisions. Ecological assessments, like the ITERS (Infant/Toddler Environment Rating Scale), ECERS (Early Childhood Environment Rating Scale), and SACERS (School-Age Care Environment Rating Scale), provide a measure of global quality, which can be used as an initial reference for contextual comparison. A setting narrative that briefly describes the context is not sufficient. Reporting both global and individual subscale quality scores from these measures, as was done here, will provide fellow researchers with a better understanding of the composition, routines, interactions, activities, and structure within the setting.

While this investigation does provide a methodological model, it is not imperative that each free play activity be independently evaluated to determine its play potential and ability to achieve learning objectives. Certainly this approach seems ideal and warranted for some investigations, but all that is really called for is a thorough description of the available provisions. Provisions should be described in observational records before and during the observation of children's free play. Prior to starting an observation, researchers should make note of the provisions that are available at each activity/center. This should not be done once, but in accordance with contextual practices. Provisions may change daily or weekly and observational records should account for these changes. As found in this investigation, a description of the activity alone may misrepresent material effects. For instance, it would be inappropriate to collectively interpret children's sensory table play if the table was filled with water on Monday/Wednesday/Friday and sand Tuesday/Thursday; the results would have to be parsed by surface for an accurate characterization. During free play observation, in

addition to recording cognitive play forms and social participation categories, researchers should be diligent in noting the materials and objects children use in their play. In doing so, they will be able to relate the object(s) to the social-cognitive context in which it occurred. Further, one would then be able interpret the observed free play behavior within the holistic context of the arranged activity (e.g., when it was filled with sand, Angela engaged in solitary-constructive play at the sensory table using the silk flowers and pots).

Children's play forms and social participation appear to be governed by their surroundings and, consequently, must be accounted for and controlled during observation. Together, quality ratings from an ecological assessment and description of available materials will help to ensure ecological consistency. Ratings and materials would assuredly vary from context to context, but generalizations could be drawn, in time, from their commonalities. Ideally, a substantial body of contemporary investigations would eventually yield a meta-analysis on children's free play behavior.

Understanding the effects of materials on children's free play is only part of the narrative. A thorough description of the materials must be coupled with an identification of who is playing with them. Methodological consistency demands attention to how the observed children are participating in free play. To control for individual differences either all of the children enrolled in the class, and not just the ones that self-select into the activity, must be observed or notation made as to when and where individual children play. Aside from material considerations, previous sensory table findings could also be explained through the failure to incorporate one of the aforementioned approaches in a methodological design for observing children's free play.

While this investigation used the term "pull" to described organized free play group behavior, it had been previously used to characterize children's probable behavior when acting on their own volition in their classroom. This latter definition is problematic for the described pull of specific activities may have only been capturing the behaviors of children who frequented them. In terms of size, the sensory table occupies a much smaller area than other centers such as fine motor/blocks and housekeeping. While most sensory tables can comfortably accommodate 2 to 3 children, block and housekeeping areas typically accommodate a few more because of the nature of the materials and allocation of space (e.g., blocks require room for construction). Sand and water, along with play dough, has long been identified as a preferred preschooler activity (Rubin, 1977a, 1977b; Tizard et al., 1976) that pulled for the lowest levels of play. Perhaps previous investigations, where the sensory table was one of the available activities, observed children who were more non-social functional because of a lack of friends, interest in activities with greater privacy, and/or preference for aimless activity.

Novelty, personality traits, popularity or perhaps some combination of these factors may contribute to a child's selection of a free play activity. Without experimental manipulation, it is difficult to speculate on free play for any of these aforementioned factors may confound the observed behaviors. The sensory experience questionnaires, dyadic play sessions, and post-observation interviews used in this investigation were designed to account for novelty, personality traits, and popularity, respectively. Taken together, it was found that most children primarily engaged in sensory play at the preschool, preferred it over other activities, and enjoyed the company of their playmate during the activity.

Pull, therefore, must define general tendencies of activities for all children and not just the likely social-cognitive behavior that represents only the children who self-select into them. Again, free play investigations may tackle this from either angle, observing all children or noting where individual children play. Both are needed to fully understand a pull in terms of general effects and individual appeal. This investigation provides perspective on the former, suggesting that when both ecology and methods are controlled the sensory table can foster a wide range of developmental possibilities. Further research is needed it understand its pull in purely naturalistic situations (i.e., individual appeal) where provisions are still experimentally manipulated.

Prior to this investigation there appeared to be a distinct dichotomy between the views of early childhood education practitioners and findings from empirical investigations on children's play behavior at the sensory table. As previously stated, early childhood practitioners identify the sensory table as an activity center that promotes development across the domains while empirical investigations suggest that it pulls for the least sophisticated forms of cognitive and social play. By focusing exclusively on the sensory table and its provisions to determine its effect on preschoolers' play behavior, the results of the present investigation suggest that both perspectives, when yoked, capture the range of this activity center's potentiality. Over the course of an academic school year a practitioner who routinely manipulates the provisions of the sensory table, perhaps in accordance with weekly themes, may very well observe the sensory table to promote problem-solving abilities, imagination, verbal communication, self-esteem, conflict negotiation, and hand-eye coordination (Morris, 1990: West & Cox, 2001). Conversely, a researcher who uses a scan sampling approach to measure preschoolers' free play behavior during center time for a 2-

week period would likely find the sensory table to be purely sensorimotor if only water play with a variety of cups and spoons was observed. Observations of children's play behavior at the sensory table can certainly range from cognitively and socially lean to rich; the directionality appears dependent upon the ecological composition of the sensory table.

Table 1

Minimally Structured Object Set and Corresponding Highly Structured Object Set

Minimally Structured Object Set	Highly Structured Object Set
3 animal cookie cutters	3 animal figures
3 sea animal cookie cutters	3 sea animal figures
2 small buckets	2 plastic flower pots
4 wooden dowels with painted sphere tops	4 plastic/silk flowers
1 set of plastic tubes (various sizes)	1 funnel set
2 plastic soap dishes	2 small boats
2 insect cookie cutters	2 insect figures
1 set of spoons in assorted sizes	1 set of measuring spoons
2 small plastic mixing bowls	2 small cake pans
2 snack-sized Ziploc bags with beans	2 packets of seeds
4 doll clothespin painted people	4 *Disney's Little Einstein* figurines
4 wooden 2-dimensional seashells	4 seashells
2 small plastic shovels	2 small garden shovels
2 plastic sifters	2 flour sifters
2 rectangular sponges	2 fruit-shaped sponges
2 wooden block shaped vehicles	2 small vehicles
2 plastic cups	2 small watering cans

Table 2

Conceivable Surface-Provision Combinations: Measure & Containment Supplies

Rocks	Sand	Soil	Water
Assorted Spoons	Assorted Spoons	Assorted Spoons	Assorted Spoons
Buckets/Pots	Buckets/Pots	Buckets/Pots	Buckets/Pots
Cake Pans	Cake Pans	Cake Pans	Cake Pans
Funnel Set	Funnel Set	Funnel Set	Funnel Set
Measuring Spoons	Measuring Spoons	Measuring Spoons	Measuring Spoons
Mixing Bowls	Mixing Bowls	Mixing Bowls	Mixing Bowls
Plastic Cups	Plastic Cups	Plastic Cups	Plastic Cups
Plastic Tubes	Plastic Tubes	Plastic Tubes	Plastic Tubes
Shovels	Shovels	Shovels	
	Sifters		Sifters
			Sponges
		Watering Cans	Watering Cans

Table 3

Conceivable Surface-Provision Combinations: Animal Supplies

Rocks	Sand	Soil	Water
Animal Figures	Animal Figures	Animal Figures	
Insect Figures	Insect Figures	Insect Figures	
People Figures	People Figures	People Figures	People Figures
	Sea Animal Figures		Sea Animal Figures

Table 4

Conceivable Surface-Provision Combinations: Transportation Supplies

Rocks	Sand	Soil	Water
Small Vehicles	Small Vehicles	Small Vehicles	Boats Soap Dishes

Table 5

Conceivable Surface-Provision Combinations: Marine & Plant Supplies

Rocks	Sand	Soil	Water
Seashells	Beans Plastic Flowers Seashells Seeds Wooden Dowels	Beans Plastic Flowers Seeds Wooden Dowels	Seashells

Table 6

Conceivable Play Themes

Rocks	Sand	Soil	Water
Animal Habitats	Animal Habitats	Animal Habitats	
Aquarium			
Baking/Cooking	Baking/Cooking	Baking/Cooking	Baking/Cooking
	Beach Party		
Dump and Fill	Dump and Fill	Dump and Fill	Dump and Fill
			Float and Sink
	Garden	Garden	
			Marine Dock
		Plant Nursery	
Transportation	Transportation		
			Under the Sea

Table 7

Participant Observation Schedule: MWF am

Week	1	2	3	4	5	6	7	8
Order	Z/C	C/O	K/D	A/G	N/H	C/D	Z/C	C/O
	C/O	K/D	A/G	N/H	C/D	Z/C	C/O	K/D
	K/D	A/G	N/H	C/D	Z/C	C/O	K/D	A/G
	A/G	N/H	C/D	Z/C	C/O	K/D	A/G	N/H
	N/H	C/D	Z/C	C/O	K/D	A/G	N/H	C/D
	C/D	Z/C	C/O	K/D	A/G	N/H	C/D	Z/C

Table 8

Participant Observation Schedule: MWF pm

Week	1	2	3	4	5	6	7	8
Order	A/J	C/C	I/M	V/A	A/A	C/S	A/J	C/C
	C/C	I/M	V/A	A/A	C/S	A/J	C/C	I/M
	I/M	V/A	A/A	C/S	A/J	C/C	I/M	V/A
	V/A	A/A	C/S	A/J	C/C	I/M	V/A	A/A
	A/A	C/S	A/J	C/C	I/M	V/A	A/A	C/S
	C/S	A/J	C/C	I/M	V/A	A/A	C/S	A/J

Table 9

Participant Observation Schedule: TR am

Week	1	2	3	4	5	6	7	8
Order	J/C J/M E/M	J/M E/M J/C	E/M J/C J/M	J/C J/M E/M	J/M E/M J/C	E/M J/C J/M	J/C J/M E/M	J/M E/M J/C

Table 10

Participant Observation Schedule: TR pm

Week	1	2	3	4	5	6	7	8
Order	R/K C/A J/E	C/A J/E R/K	J/E R/K C/A	R/K C/A J/E	C/A J/E R/K	J/E R/K C/A	R/K C/A J/E	C/A J/E R/K

Table 11

Surface & Provision Set Presentation Order

A	B	C
Water (U)	Soil (R)	Sand (U)
Sand (R)	Water (U)	Rocks (R)
Soil (U)	Rocks (R)	Water (U)
Rocks (R)	Sand (U)	Soil (R)
Water (R)	Soil (U)	Sand (R)
Sand (U)	Water (R)	Rocks (U)
Soil (R)	Rocks (U)	Water (R)
Rocks (U)	Sand (R)	Soil (U)

(R) Highly Structured Object Set

(U) Minimally Structured Object Set

Table 12

Surface Presentation Order: Dyad Assignments

A	B	C
1mm	3mm	5mm
2mm	4mm	6mm
7ff	8ff	12ff
	9ff	
	10ff	
	11ff	
13mf		16mf
14mf		17mf
15mf		18mf

Order A: MWF am

Order B: MWF pm

Order C: TR am & pm

Table 13

Means and Standard Deviations for Functional Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	3.1383	1.6667	1.3333	0.7500	1.3333	1.4717	2.0833	0.8333
	SD	1.6806	0.8627	1.2465	0.6574	1.3944	1.3735	1.3404	0.3947
M/M	Mean	2.5000	2.2500	0.9167	1.0567	1.1683	1.0833	2.4467	1.2233
	SD	0.4578	0.8274	0.6579	0.8612	1.0044	0.6563	0.6027	0.5721
M/F	Mean	3.5817	2.9717	2.7500	1.3333	2.6117	1.6933	3.0017	2.3600
	SD	0.9751	0.9970	1.1680	0.9530	1.2184	1.7482	0.7816	1.0078
Total	Mean	3.0733	2.2961	1.6667	1.0467	1.7044	1.4161	2.5106	1.4722
	SD	1.1750	1.0071	1.2796	0.8200	1.3212	1.2836	0.9828	0.9407

M = Minimally Structured Object Set
H = Highly Structured Object Set

Table 14

Means and Standard Deviations for Constructive Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	0.5850	1.4450	2.9717	2.2783	2.3050	2.3333	1.3033	2.7500
	SD	0.8226	0.8932	1.2775	1.1430	1.7040	0.9766	1.3382	0.9799
M/M	Mean	0.3617	0.4450	2.5283	1.3883	2.4150	1.2500	1.0817	1.1683
	SD	0.3555	0.2707	1.3259	0.7851	1.7482	0.7295	0.5665	0.9118
M/F	Mean	0.4183	0.1117	1.2500	2.6117	1.5567	2.5300	1.1950	0.6950
	SD	0.5842	0.2020	1.1833	1.5459	1.0999	1.4985	0.8785	0.7254
Total	Mean	0.4550	0.6672	2.2500	2.0928	2.0922	2.0378	1.1933	1.5378
	SD	0.5883	0.7798	1.4046	1.2453	1.5042	1.1970	0.9256	1.2244

M = Minimally Structured Object Set
H = Highly Structured Object Set

Table 15

Means and Standard Deviations for Dramatic Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	0.8333	1.3600	0.4433	1.6950	1.1100	0.8900	0.6667	0.6933
	SD	1.2910	0.9461	0.9337	1.1436	1.5050	0.4905	0.7377	0.9554
M/M	Mean	1.6100	1.8050	1.2217	2.0300	1.1117	2.0283	0.8617	1.2500
	SD	0.7431	0.7637	0.9950	1.0973	0.8740	0.2448	0.4878	0.3443
M/F	Mean	0.5550	1.3883	0.4717	0.5567	0.3067	0.3600	0.2783	0.6650
	SD	0.3602	0.8476	0.6711	0.6646	0.5007	0.2227	0.4035	0.7076
Total	Mean	0.9994	1.5178	0.7122	1.4272	0.8428	1.0928	0.6022	0.8694
	SD	0.9496	0.8306	0.9042	1.1357	1.0568	0.7848	0.5833	0.7262

M = Minimally Structured Object Set
H = Highly Structured Object Set

Table 16

Means and Standard Deviations for Solitary Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	2.0000	2.5850	1.9717	2.5533	1.9717	2.1400	2.7233	2.9733
	SD	1.0225	0.4906	0.9502	0.7640	1.0394	1.0507	1.1087	0.8765
M/M	Mean	3.0000	3.0833	2.6950	2.6933	2.4733	3.2500	3.0000	2.9717
	SD	1.0272	0.7048	1.2782	1.0396	1.1288	0.9285	1.1938	0.7631
M/F	Mean	3.3067	3.2767	2.1667	3.5283	3.2217	3.4983	2.8333	3.0283
	SD	0.9635	1.3150	1.3978	0.7838	1.0863	0.8363	1.6240	1.1072
Total	Mean	2.7689	2.9817	2.2778	2.9250	2.5556	2.9628	2.8522	2.9911
	SD	1.1047	0.9030	1.1915	0.9308	1.1484	1.0739	1.2530	0.8710

M = Minimally Structured Object Set
H = Highly Structured Object Set

Table 17

Means and Standard Deviations for Parallel Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	1.5267	0.8050	1.3600	0.6933	0.8067	1.1933	0.3617	0.4433
	SD	1.2395	0.8773	0.5913	0.6339	0.3553	0.8113	0.3555	0.4558
M/M	Mean	0.3883	0.4717	0.1950	0.8050	0.7517	0.4433	0.6667	0.2517
	SD	0.2289	0.3549	0.3220	0.6370	0.7854	0.3424	0.6970	0.2033
M/F	Mean	1.1383	0.8067	1.8600	0.6400	1.1100	0.7500	1.1383	0.8333
	SD	0.8775	0.8923	1.1312	0.6100	0.7567	0.5644	1.1377	0.6751
Total	Mean	1.0178	0.6944	1.1383	0.7128	0.8894	0.7956	0.7222	0.5094
	SD	0.9644	0.7238	1.0124	0.5932	0.6429	0.6497	0.8178	0.5190

M = Minimally Structured Object Set
H = Highly Structured Object Set

Table 18

Means and Standard Deviations for Social Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	1.0533	1.3333	1.5283	1.5283	2.1950	1.3883	1.7200	1.0267
	SD	0.9462	0.4066	0.6276	0.5098	1.0187	1.2108	1.35242	1.0374
M/M	Mean	1.2500	1.0567	1.9433	1.2217	1.5550	1.0283	1.1117	0.8900
	SD	1.0058	0.4683	1.1501	0.7102	1.0619	0.8662	0.76445	0.6875
M/F	Mean	0.1100	0.4733	0.5550	0.4450	0.1383	0.3883	0.5550	0.3067
	SD	0.1704	0.5410	0.9572	0.5742	0.2209	0.4907	0.53306	0.2207
Total	Mean	0.8044	0.9544	1.3422	1.0650	1.2961	0.9350	1.1289	0.7411
	SD	0.9119	0.5790	1.0644	0.7361	1.1972	0.9507	1.01640	0.7570

M = Minimally Structured Object Set
H = Highly Structured Object Set

Table 19

Means and Standard Deviations for Solitary-Functional Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	1.4450	0.9450	0.6667	0.4717	0.7783	0.6650	1.5300	0.8050
	SD	1.0788	0.4892	0.7224	0.4404	1.0634	0.5465	1.1270	0.3711
M/M	Mean	1.6933	1.7500	0.7783	0.7500	0.8067	0.8883	1.5833	0.9733
	SD	0.6529	0.7708	0.6636	0.7058	0.8901	0.5098	0.5012	0.4009
M/F	Mean	2.6367	2.4733	1.4183	1.0833	1.6683	1.2767	2.0567	1.5833
	SD	0.7840	1.2281	1.1484	0.7034	0.9140	1.1667	1.3034	0.7451
Total	Mean	1.9250	1.7228	0.9544	0.7683	1.0844	0.9433	1.7233	1.1206
	SD	0.9630	1.0494	0.8871	0.6444	0.9960	0.7952	1.0032	0.6078

M = Minimally Structured Object Set
H = Highly Structured Object Set

Table 20

Means and Standard Deviations for Solitary-Constructive Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	0.0833	0.8883	1.1100	0.9167	0.8900	0.9717	0.6383	1.7500
	SD	0.1387	0.7631	0.7353	0.7063	0.5754	0.5333	0.7255	0.9714
M/M	Mean	0.1383	0.1667	1.0000	0.5833	0.9717	0.9433	0.6667	0.7500
	SD	0.2209	0.1476	0.5861	0.5571	0.7340	0.8208	0.6227	0.7267
M/F	Mean	0.3350	0.0283	0.3350	1.8067	1.2500	1.9183	0.6667	0.5000
	SD	0.5768	0.0694	0.3320	1.1466	1.0955	1.2146	0.5275	0.5564
Total	Mean	0.1856	0.3611	0.8150	1.1022	1.0372	1.2778	0.6572	1.0000
	SD	0.3609	0.5742	0.6454	0.9524	0.7962	0.9660	0.5924	0.9126

M = Minimally Structured Object Set
H = Highly Structured Object Set

Table 21

Means and Standard Deviations for Solitary-Dramatic Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	0.4733	0.6950	0.1950	1.1667	0.2767	0.5017	0.5000	0.3333
	SD	0.7501	0.4640	0.4002	0.9727	0.3087	0.4230	0.5268	0.5164
M/M	Mean	1.0567	1.1383	0.8317	1.2783	0.6667	1.2200	0.6950	1.0283
	SD	0.7869	0.3583	1.0858	0.9002	0.6479	0.5450	0.5304	0.4247
M/F	Mean	0.3333	0.7500	0.3883	0.5283	0.3067	0.2517	0.0567	0.5833
	SD	0.3922	0.5159	0.5024	0.6624	0.5007	0.2745	0.0878	0.7286
Total	Mean	0.6211	0.8611	0.4717	0.9911	0.4167	0.6578	0.4172	0.6483
	SD	0.7048	0.4696	0.7371	0.8725	0.5084	0.5835	0.4921	0.6124

M = Minimally Structured Object Set
H = Highly Structured Object Set

Table 22

Means and Standard Deviations for Parallel-Functional Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	1.3333	0.2783	0.4183	0.1667	0.3617	0.5283	0.1667	0.0283
	SD	1.3848	0.2279	0.5247	0.3320	0.4779	0.8407	0.2103	0.0694
M/M	Mean	0.3033	0.2217	0.0283	0.1967	0.1400	0.1117	0.3633	0.1683
	SD	0.1634	0.2009	0.0694	0.2464	0.1950	0.2020	0.2876	0.1826
M/F	Mean	0.8883	0.3617	1.1950	0.1383	0.8617	0.3883	0.7767	0.6400
	SD	0.8136	0.4147	0.9858	0.2209	0.7486	0.6378	0.8073	0.7400
Total	Mean	0.8417	0.2872	0.5472	0.1672	0.4544	0.3428	0.4356	0.2789
	SD	0.9772	0.2850	0.7856	0.2554	0.5828	0.6093	0.5454	0.4948

M = Minimally Structured Object Set
H = Highly Structured Object Set

Table 23

Means and Standard Deviations for Parallel-Constructive Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	0.0833	0.1933	0.8900	0.1667	0.3617	0.6400	0.1667	0.3617
	SD	0.1387	0.3387	0.6987	0.2797	0.4409	0.5913	0.2582	0.4005
M/M	Mean	0	0.1117	0.1400	0.2783	0.1117	0.0850	0.1933	0.0550
	SD	0	0.1356	0.2684	0.2727	0.1356	0.0931	0.3387	0.1347
M/F	Mean	0.0833	0.0283	0.5567	0.5017	0.2500	0.2500	0.1950	0.1100
	SD	0.2041	0.0694	0.4558	0.6836	0.3443	0.2293	0.1942	0.1704
Total	Mean	0.0556	0.1111	0.5289	0.3156	0.2411	0.3250	0.1850	0.1756
	SD	0.1398	0.2130	0.5706	0.4504	0.3294	0.4221	0.2542	0.2827

M = Minimally Structured Object Set
H = Highly Structured Object Set

Table 24

Means and Standard Deviations for Parallel-Dramatic Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	0.1117	0.3333	0.0550	0.2233	0.0833	0.0283	0.0283	0.0567
	SD	0.2020	0.6055	0.1347	0.3895	0.2041	0.0694	0.0694	0.0878
M/M	Mean	0.1117	0.1400	0.0283	0.3350	0.2233	0.2500	0.0833	0
	SD	0.1356	0.1249	0.0694	0.3320	0.3895	0.2532	0.1387	0
M/F	Mean	0.1667	0.4167	0.0833	0	0	0.1117	0.1667	0.0567
	SD	0.2582	0.5359	0.2041	0	0	0.1356	0.3320	0.0878
Total	Mean	0.1300	0.2967	0.0556	0.1861	0.1022	0.1300	0.0928	0.0378
	SD	0.1942	0.4595	0.1398	0.3124	0.2566	0.1858	0.2072	0.0727

M = Minimally Structured Object Set
H = Highly Structured Object Set

Table 25

Means and Standard Deviations for Social-Functional Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	0.3617	0.4467	0.2217	0.0567	0.1933	0.2783	0.3883	0
	SD	0.2682	0.4309	0.2009	0.0878	0.1621	0.6023	0.3441	0
M/M	Mean	0.5000	0.2767	0.0833	0.1100	0.2217	0.0850	0.5017	0.0833
	SD	0.4457	0.2274	0.1387	0.1704	0.2727	0.0931	0.3807	0.2041
M/F	Mean	0.0567	0.1383	0.1383	0.1117	0.0833	0.0283	0.1667	0.1400
	SD	0.0878	0.1624	0.2209	0.2020	0.1387	0.0694	0.2582	0.1950
Total	Mean	0.3061	0.2872	0.1478	0.0928	0.1661	0.1306	0.3522	0.0744
	SD	0.3438	0.3073	0.1879	0.1533	0.1976	0.3504	0.3428	0.1642

M = Minimally Structured Object Set
H = Highly Structured Object Set

Table 26

Means and Standard Deviations for Social-Constructive Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	0.4167	0.3633	0.9717	0.8333	1.0567	0.7233	0.5000	0.6383
	SD	0.7869	0.3038	0.6453	0.7157	0.9029	0.9095	0.5268	0.7486
M/M	Mean	0.2233	0.1683	1.3883	0.5283	1.0550	0.2233	0.2217	0.3617
	SD	0.2515	0.1826	0.8476	0.2448	0.9304	0.2515	0.2009	0.3039
M/F	Mean	0	0.0567	0.3617	0.3067	0.0550	0.3600	0.3333	0.0850
	SD	0	0.0878	0.6187	0.4274	0.1347	0.4517	0.4083	0.0931
Total	Mean	0.2133	0.1961	0.9072	0.5561	0.7222	0.4356	0.3517	0.3617
	SD	0.4811	0.2371	0.7966	0.5209	0.8576	0.6075	0.3955	0.4986

M = Minimally Structured Object Set
H = Highly Structured Object Set

Table 27

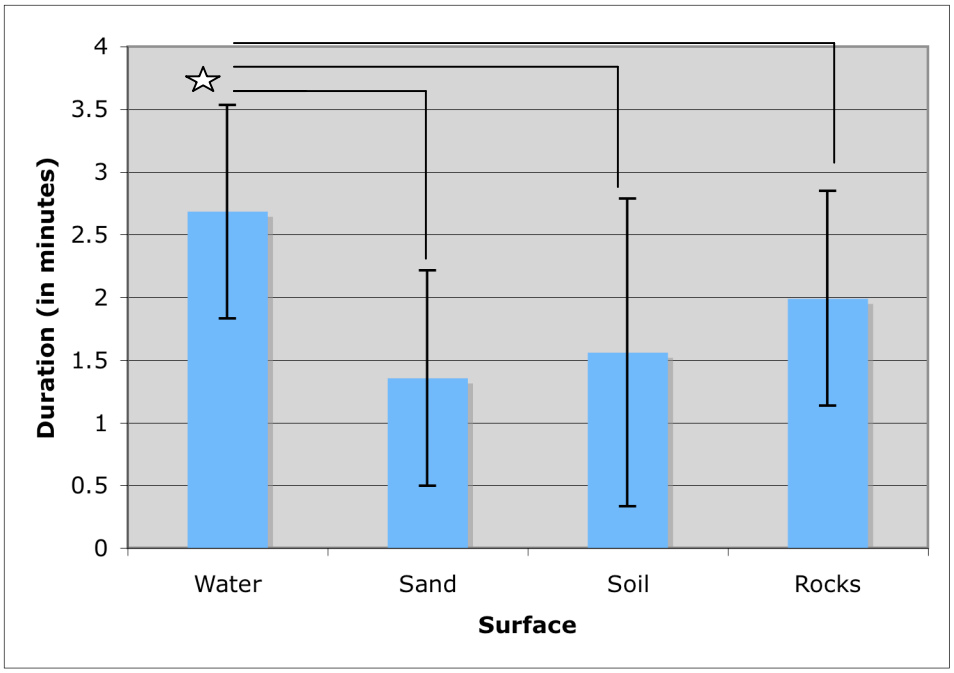
Means and Standard Deviations for Social-Dramatic Play

Dyad		Water		Sand		Soil		Rocks	
		M	H	M	H	M	H	M	H
F/F	Mean	0.2500	0.3333	0.1950	0.3067	0.7500	0.3617	0.1383	0.3067
	SD	0.3906	0.3320	0.4002	0.2876	1.1630	0.3555	0.2209	0.4655
M/M	Mean	0.4717	0.5283	0.3617	0.4150	0.2233	0.5567	0.0833	0.2217
	SD	0.4133	0.5004	0.2645	0.5538	0.2928	0.5430	0.1387	0.2009
M/F	Mean	0.0567	0.2217	0	0.0283	0	0	0.0550	0.0283
	SD	0.0878	0.3589	0	0.0694	0	0	0.1347	0.0694
Total	Mean	0.2594	0.3611	0.1856	0.2500	0.3244	0.3061	0.0922	0.1856
	SD	0.3575	0.4012	0.3013	0.3795	0.7264	0.4245	0.1632	0.3023

M = Minimally Structured Object Set
H = Highly Structured Object Set

Figure 1

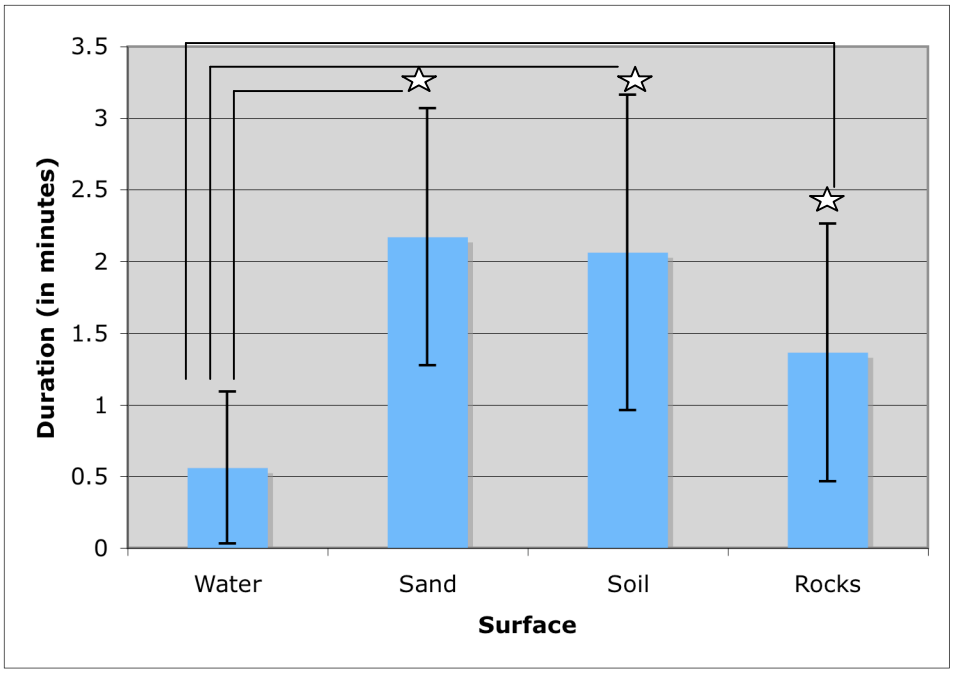
Surface Means and Standard Deviations for Functional Play



☆ $p < .01$

Figure 2

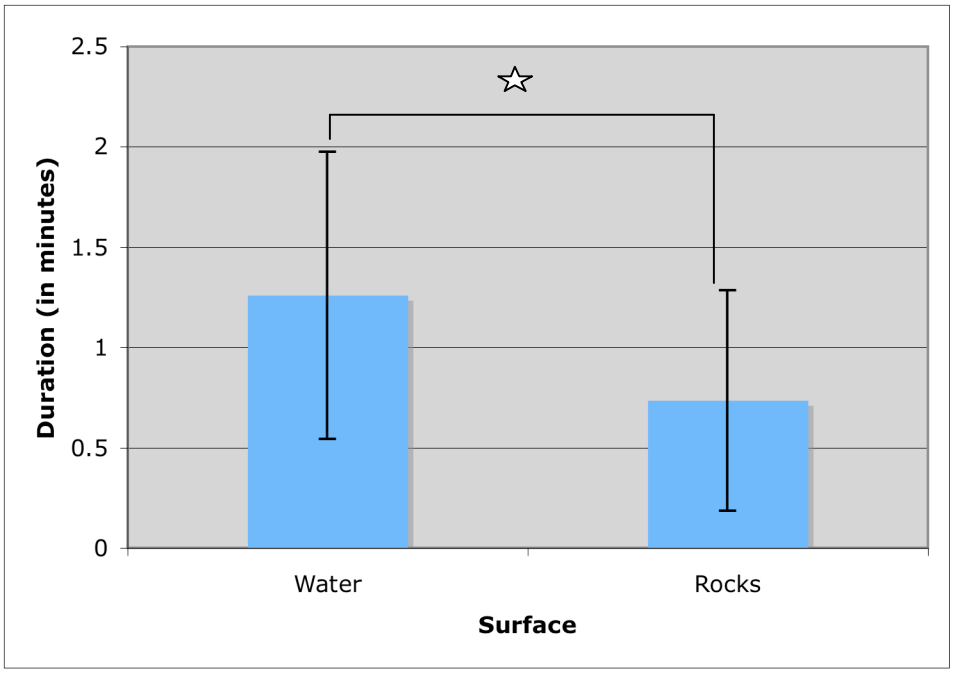
Surface Means and Standard Deviations for Constructive Play



☆ $p < .01$

Figure 3

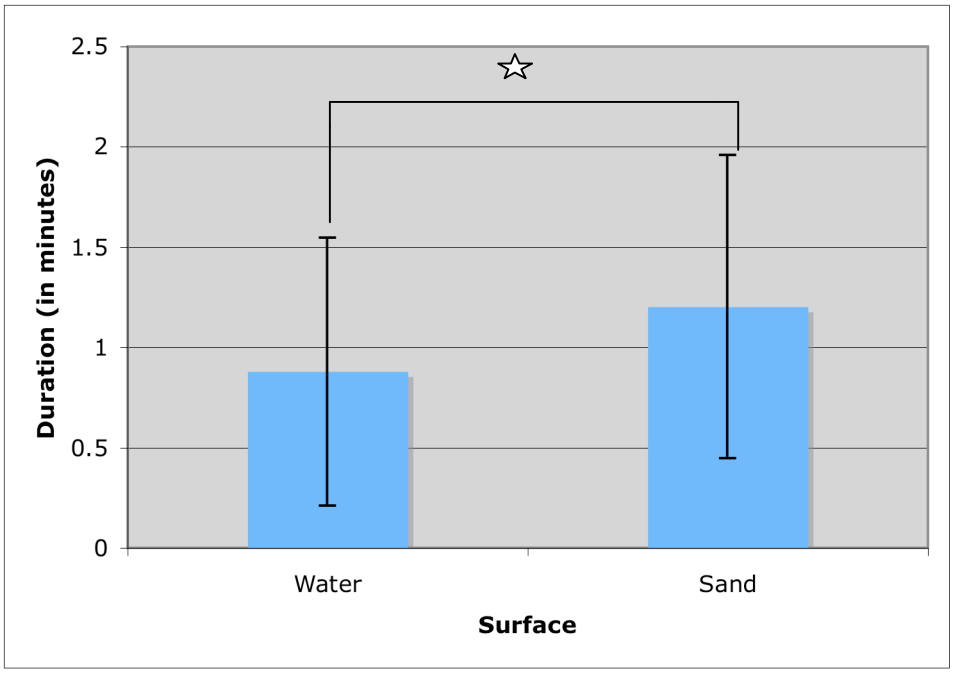
Surface Means and Standard Deviations for Dramatic Play



☆ $p = .01$

Figure 4

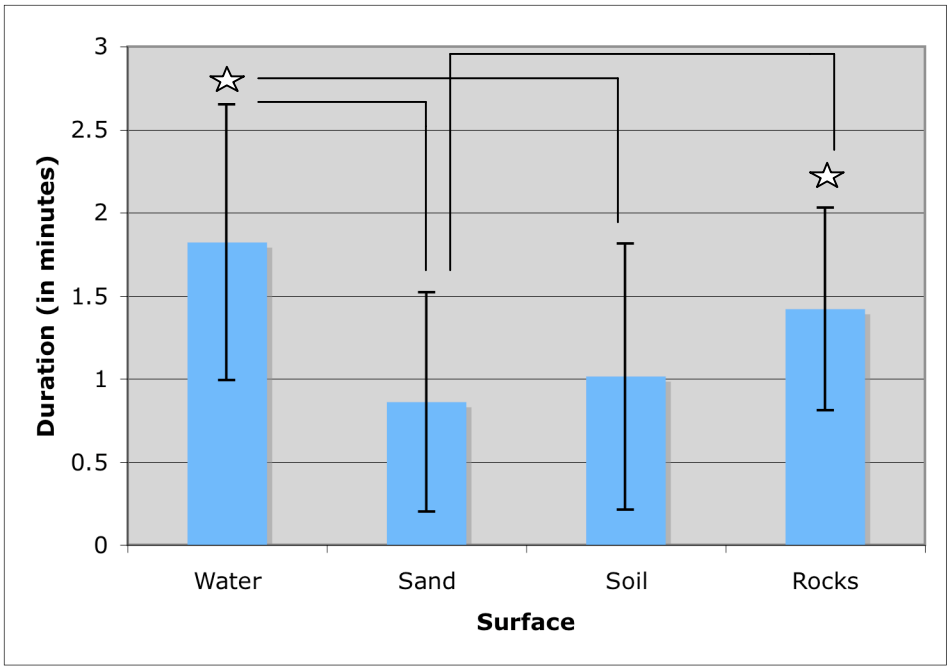
Surface Means and Standard Deviations for Social Play



☆ $p = .054$

Figure 5

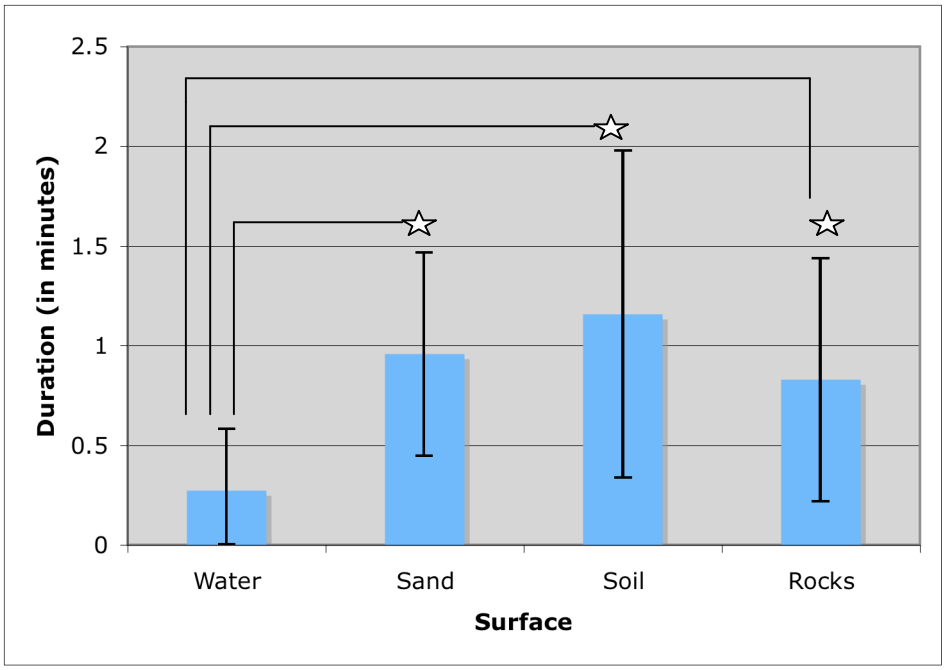
Surface Means and Standard Deviations for Solitary-Functional Play



☆ $p < .05$

Figure 6

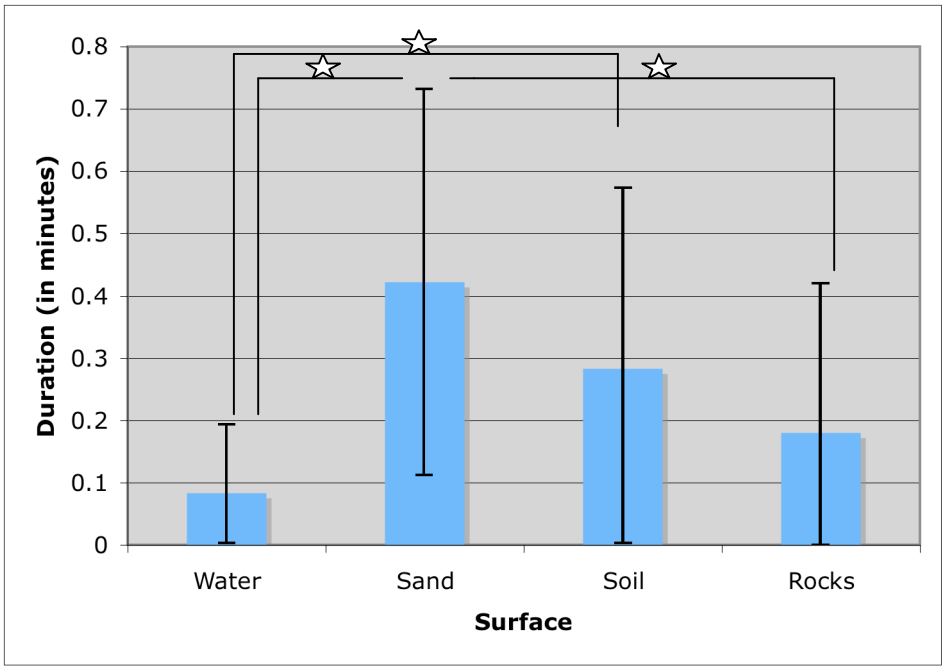
Surface Means and Standard Deviations for Solitary-Constructive Play



☆ $p < .01$

Figure 7

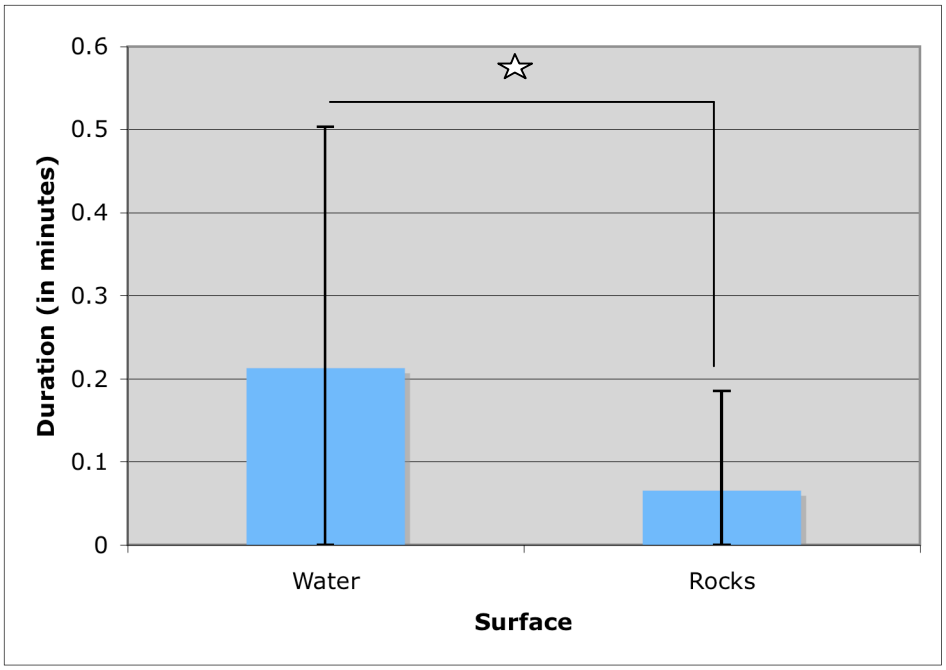
Surface Means and Standard Deviations for Parallel-Constructive Play



☆ $p < .05$

Figure 8

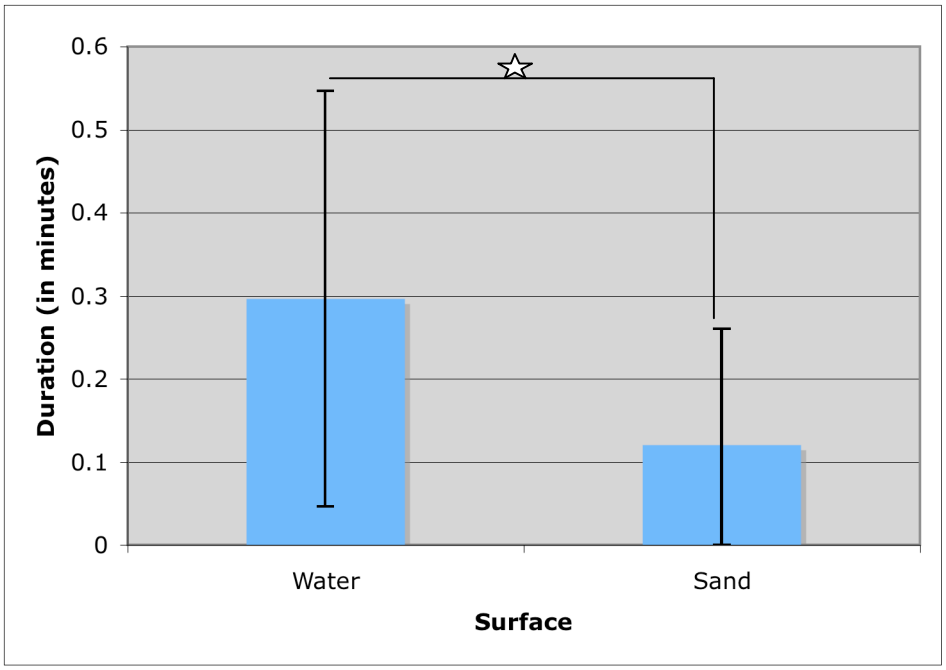
Surface Means and Standard Deviations for Parallel-Dramatic Play



☆ $p = .10$

Figure 9

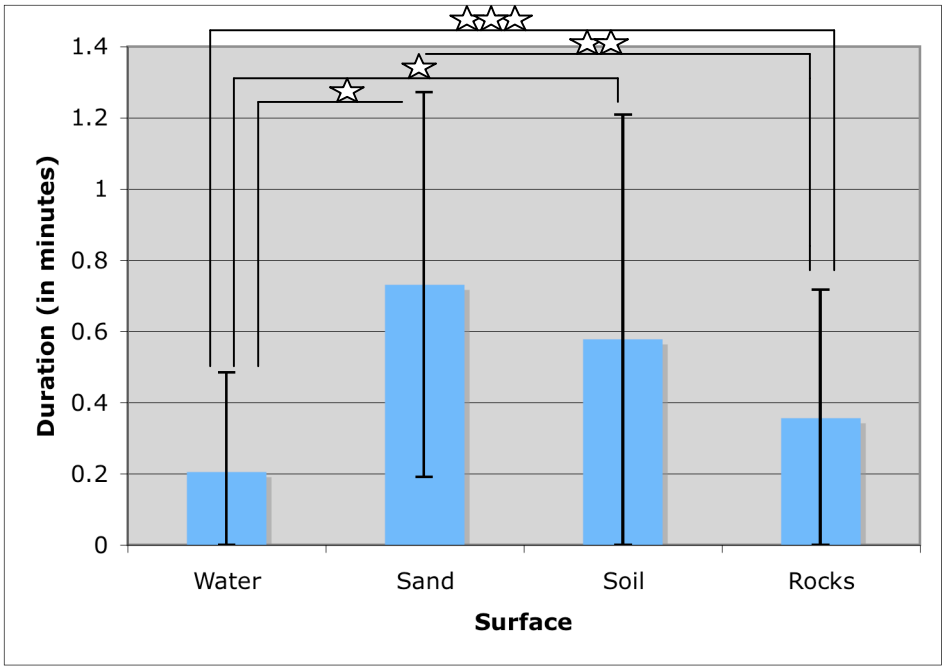
Surface Means and Standard Deviations for Social-Functional Play



☆ $p < .05$

Figure 10

Surface Means and Standard Deviations for Social-Constructive Play



☆ $p < .01$

☆ ☆ $p = .01$

☆ ☆ ☆ $p = .05$

APPENDIX A

PARENT LETTER

[INSERT DATE HERE]

Dear Parents,

I would like to take this opportunity to introduce myself and describe an activity that will be occurring this fall in the PreK3 classes. My name is James Morgante and I am currently a fourth year doctoral candidate in the Department of Psychology at the University of Massachusetts, Amherst. My current work has focused on infant and toddler visual-motor development. Specifically, my studies have examined preschoolers' eye movement behavior during the observation of action sequences, infants' exploration of objects in the absence of vision (i.e., in the dark), and the influence of material properties on infants' and toddlers' exploratory and play behaviors. In cooperation with Kathy Schroder and the PreK3 classroom teachers, I have the distinct privilege of conducting my next research project at Holy Cross Lutheran Preschool.

At the University of Massachusetts, we have been conducting projects on children's development for more than twenty years. If you have internet access, you can view some of our work at http://www.umass.edu/devpsych/. I am contacting you at this time to invite you and your child to participate in one of our current projects designed for the children of the PreK3 classes.

During center time, children will be asked to participate in an activity at the sensory table. In September and October, various surfaces will be presented at the sensory table (e.g., grass, pebbles, sand, and water). The surface will vary weekly, though the toys at the sensory table will remain the same. Children's use of the toys, surface, and toy-surface combinations will be observed and recorded. Their play forms (e.g., functional, constructive, pretend, and games) and social participation at the sensory table will be considered in relation to the surfaces to determine the effectiveness of particular surface types in promoting peer interaction and the development of problem solving and reasoning abilities.

There are no discomforts or risks involved with this project, and parents and their children usually find these experiences to be interesting and fun. I am always happy to show parents the videotapes after the sessions and to discuss the findings of this particular study as well as other studies that we have conducted. All of the observational data that is collected will remain strictly confidential. Participation in this study involves four weekly 8-minute observations of your child's play at the sensory table during center time. Even though the project is integrated in the daily classroom routine, participation is entirely voluntary.

Our work has led to new insights about development in children and none of it would be possible without the assistance of parents in the community. I would be extremely grateful for your participation. I will try to call you in the near future to see if you would like to participate. For further information, please call me at (609) 468-2508 or contact me by e-mail at jmorgant@psych.umass.edu

Thank you very much for considering participating in this project.

Sincerely,
James Morgante

APPENDIX B

SENSORY EXPERIENCE QUESTIONNAIRE

Name: _____

Session:
Please circle one: MWF am MWF pm TTH am TTH pm

Sensory Experience Questionnaire

Please circle your responses

1. If you are a homeowner or home lessee, does your household have a sandbox or sand/water table?

    a. Yes, a sandbox.
    b. Yes, a sand/water table.
    c. Yes, both a sandbox and sand/water table.
    d. No.

2. If you live in an apartment or condominium, does your complex have a sandbox or sand/water table in a community area or playground?

    a. Yes, a sandbox.
    b. Yes, a sand/water table.
    c. Yes, both a sandbox and sand/water table.
    d. No.

3. Aside from your residence and school, does your child have an opportunity to play in a sandbox or at a sand/water table, such as at a community center, library, or park?

    a. Yes.
        i. Where? _____
    b. No.

4. Outside of school, how often does your child engage in sandbox or sand/water table play?

    a. Every Day
    b. 2-6 Times a Week
    c. About Once a Week
    d. About Once a Month
    e. Never

5. Where does your child primarily engage in sandbox or sand/water table play?

    a. Holy Cross Lutheran Preschool
    b. Home
    c. Other: _____

APPENDIX C

FUNCTIONAL OBJECT RATING

Functional Object Rating Age:_____ DOB:_____ Sex: _____

Instructions:

1. You will see 17 pairs of objects
2. Each pair is perceptually similar (e.g., color, shape), but differs in either function or realism
3. You are to rate each item according to a 5-point scale

Scale:

1 2 3 4 5
(flexible) (rigid)

Flexible:
Object has multiple uses and/or loosely resembles a real object
Rigid:
Object has a specific use and/or object appears very realistic

Set Number	Object on Left	Object on Right
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		

APPENDIX D

PLAY TABLE POST-OBSERVATION INTERVIEW

Subject :_____
Dyad:_____
Order:_____

Cinderella's Royal Table
Spring 2009

Play Table Post-Observation Interview

Name: _____

Session: MWF am MWF pm TR am TR pm

Date: _____

Script:

(Child's Name) I have some pictures of our classroom. Here is a picture of the

Kitchen Reading Center Block Area Play Table Puzzles

Which activity is your favorite?

Who do you like to play with at/in the (favorite)?

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